

**3230**

**PROJECT SPECIFIC PLAN FOR  
PADDYS RUN AND ADJACENT AREAS  
REAL-TIME SCAN**

**SOIL AND DISPOSAL FACILITY PROJECT**

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
FERNALD, OHIO**



**AUGUST 25, 2000**

**U.S. DEPARTMENT OF ENERGY  
FERNALD AREA OFFICE**

**20300-PSP-0008  
REVISION B  
DRAFT**

**000001**

**PROJECT SPECIFIC PLAN FOR  
PADDYS RUN AND ADJACENT AREAS  
REAL-TIME SCAN**

**Document Number 20300-PSP-0008**

**Draft  
Revision B**

**August 25, 2000**

**APPROVAL:**

---

Tom Crawford, Project Manager  
Soil and Disposal Facility Project

Date

---

Deanna Diallo, Characterization Lead  
Soil and Disposal Facility Project

Date

---

Joan White, Real-Time Instrumentation Measurement Program Manager  
Soil and Disposal Facility Project

Date

---

Linda Barlow, Waste Acceptance Organization  
Soil and Water Projects

Date

---

Frank Thompson, Quality Assurance  
Soil and Water Projects

Date

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
Fluor Daniel Fernald  
P.O. Box 538704  
Cincinnati, Ohio 45253-8704

**000002**

## TABLE OF CONTENTS

1.0	Introduction .....	1-1
1.1	Background.....	1-1
1.2	Purpose .....	1-2
1.3	Scope.....	1-2
1.4	Key Personnel.....	1-3
2.0	Real-Time Scanning Program .....	2-1
2.1	Initial Precertification Scan .....	2-1
2.1.1	Streambed Spot Checking .....	2-2
2.2	Confirmation.....	2-3
2.3	Hot Spot Delineation .....	2-3
2.4	Measurement Identification.....	2-4
2.5	Data Mapping .....	2-7
2.6	Surface Soil Moisture Measurements.....	2-8
2.7	Background Radon Monitoring .....	2-8
2.8	Physical Samples .....	2-8
2.9	Waste Disposition.....	2-9
3.0	Quality Assurance/Quality Control Requirements.....	3-1
3.1	Quality Control Measurements.....	3-1
3.2	Project Requirements for Surveillances .....	3-1
3.3	Field Changes to the PSP.....	3-1
3.4	Training.....	3-1
4.0	Safety and Health .....	4-1
5.0	Data Management.....	5-1
6.0	Applicable Documents, Methods, and Standards.....	6-1
Appendix A	Historical Data for Adjacent Oxbow Areas	
Appendix B	Data Quality Objectives SL-056, Revision 0	

## LIST OF TABLES

- |           |  |
|-----------|--|
| Table 1-1 | Historical Above-FRL Radiological Samples        |
| Table 1-2 | Key Personnel                                    |
| Table 2-1 | Real-Time Equipment and Detector Configurations  |
| Table 2-2 | Target Analyte List for Paddys Run HPGe Scanning |

## LIST OF FIGURES

- |            |   |
|------------|---|
| Figure 1-1 | Location of Paddys Run and Adjacent Oxbow Areas             |
| Figure 1-2 | Historical Sample Locations within the Northern Oxbow Areas |
| Figure 1-3 | Historical Sample Locations within the Southern Oxbow Areas |
| Figure 1-4 | Priority Scanning Areas within Paddys Run                   |
| Figure 2-1 | Above-FRL Locations in the Northern Oxbow Area              |
| Figure 2-2 | Above-FRL Locations in the Southern Oxbow Area              |
| Figure 5-1 | Real-Time Electronic Data Quality Control Checklist         |

000004

### LIST OF ACRONYMS AND ABBREVIATIONS

A8PI	Area 8, Phase I
A8PIII	Area 8, Phase III
ASCOC	area-specific constituent of concern
ASL	analytical support level
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	constituent of concern
CU	certification unit
dpm	disintegrations per minute
DOE	U.S. Department of Energy
DQO	Data Quality Objective
ECDC	Engineering/Construction Document Control
FACTS	Fernald Analytical Computerized Tracking System
FEMP	Fernald Environmental Management Project
FRL	final remediation level
GPS	Global Positioning System
HPGe	high-purity germanium (detector)
LAN	Local Area Network
mg/kg	milligrams per kilogram
mph	miles per hour
NaI	sodium iodide
OU2	Operable Unit 2
OU5	Operable Unit 5
pCi/g	picoCuries per gram
ppm	parts per million
PSP	Project Specific Plan
QA	Quality Assurance
RI/FS	Remedial Investigation/Feasibility Study
RMS	Radiation Measurement Systems
RSS	Radiation Scanning System
RTIMP	Real-Time Instrumentation Measurement Program
RTRAK	Radiation Tracking System
SCQ	Sitewide CERCLA Quality Assurance Project Plan
SDFP	Soil and Disposal Facility Project
SED	Sitewide Environmental Database
TAL	Target Analyte List
TBD	to be determined
V/FCN	Variance/Field Change Notice
WAO	Waste Acceptance Organization

**1.0 INTRODUCTION**

3 This project specific plan (PSP) describes predesign and precertification final remediation level (FRL)  
4 scanning within the Paddys Run stream corridor and two adjacent oxbow areas. The data collected under  
5 this plan will be used to assess radiological contamination, if any, within Paddys Run and the adjacent  
6 oxbow areas.

7

**8 1.1 BACKGROUND**

9 Paddys Run stream traverses the western portion of the Fernald Environmental Management Project  
10 (FEMP) property (Figure 1-1) and is approximately 10,500 feet in length. It receives concentrated  
11 stormwater that flows from the Pilot Plant Drainage Ditch and the Storm Sewer Outfall Ditch.

12

13 Within the boundaries of the FEMP, the stream has two adjacent oxbow areas. The southernmost oxbow  
14 area is highly vegetated and extends to the west along Area 8, Phase III (A8PIII). In 1962, a berm was  
15 created along the northern section of Paddys Run to mitigate erosion into the Waste Pits. The northern  
16 oxbow area formed as a result of this berm and stream channel movement. In 1967, additional erosion  
17 mitigation along Paddys Run road resulted in straightening and diversion of the streambed. The southern  
18 oxbow area formed as a result of this southern streambed earthwork.

19

20 The Operable Unit 5 (OU5) Remedial Investigation/Feasibility Study (RI/FS) includes a 1986 Dames  
21 and Moore radiological survey of Paddys Run. The survey was conducted from the confluence of  
22 Paddys Run and the Great Miami River to the on-site railroad trestle bridge located north of the waste  
23 storage area and included a comprehensive radiological walkover survey of the stream bottom and banks.  
24 A map of the survey was included in the RI/FS and shows two areas with elevated gamma readings.  
25 Quantitative field frisker measurement values are not stated in the RI/FS.

26

27 Historical sampling and analysis data from Paddys Run, the adjacent oxbow areas, and a 50-foot buffer  
28 area are summarized in Appendix A and locations are plotted in Figures 1-2 and 1-3. Several sample  
29 locations (see Table 1-1) have above-FRL historical radiological contamination at surface.

30

31 Further investigation of these locations with HPGe measurements is discussed in Section 2.1.

32

1. Only one non-radiological sample (061030), located east of the northern oxbow area, shows a detected  
2. result [20 parts per million (ppm)] greater than the FRL (15 ppm) for the pesticide compound dieldrin.  
3. This sample location will not be further investigated within this PSP since it lies in the buffer area  
4. outside of the oxbow area and since all other pesticide compounds at that sample location are below  
5. FRL.

6.

7. **1.2 PURPOSE**

8. The objectives of this predesign and precertification FRL scanning activity are to: 1) identify and  
9. evaluate any patterns of surface contamination, 2) determine if excavation of above-FRL soil for  
10. radium-226, thorium-232, and total uranium is necessary, and 3) identify visible surface debris within the  
11. stream corridor. These objectives will be accomplished through real-time scanning, as described in  
12. Section 2.0, and walkdowns within the stream corridor. Due to the dynamic deposition in the streambed,  
13. data collection in portions of the stream corridor may require reiterative scanning since some of the  
14. tributaries (i.e., Pilot Plant Drainage Ditch) and bordering FEMP property are not currently certified.

15.

16. **1.3 SCOPE**

17. The scope of this PSP is limited to predesign and precertification FRL scanning activities within the  
18. Paddys Run streambed, from the northern FEMP boundary to the southern FEMP boundary, including  
19. the accessible adjacent areas. This includes scanning, confirmation measurements and, if necessary, hot  
20. spot delineation. The real-time scanning will be conducted as weather permits. The first priority will be  
21. to focus on the two adjacent oxbow areas and the stretch of Paddys Run that traverses the Area 1 and  
22. Area 8 certified areas (Figure 1-4). The remaining Paddys Run stream corridor that traverses the  
23. uncertified areas will be spot checked to help determine possible contamination. Complete  
24. precertification surface coverage will be conducted when north, east and west boundaries are certified  
25. and upstream sources of contamination are mitigated. The real-time scanning approach will be  
26. consistent with the User Guidelines, Measurement Strategies, and Operational Factors for Deployment of  
27. In-Situ Gamma Spectrometry at the Fernald Site (User's Manual). Field activities will be consistent with  
28. the Sitewide Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)  
29. Quality Assurance Project Plan (SCQ), and Data Quality Objectives (DQO) SL-056, Revision 0  
30. (Appendix B).

31.

000007

- 1 All visible debris encountered during real-time scanning field work will be frisked using a beta/gamma frisker per Section 2.1.1.
- 2
- 3

- 4 **1.4 KEY PERSONNEL**

- 5 Key personnel responsible for performance of the project are listed in Table 1-2.

1  
2  
3  
**TABLE 1-1**  
**HISTORICAL ABOVE-FRL RADIOLOGICAL SAMPLES**

Sample ID	Radiological Isotope	Northing	Easting
WPS-A-14	Thorium-228	481152.42	1346513.65
WP-SS-21	Thorium-228	481480.99	1346306.93
WP-SS-21	Thorium-232	481480.99	1346306.93
WP-SS-21	Uranium, Total	481480.99	1346306.93
WP-SS-22	Radium-226	481681.00	1346319.94
WP-SS-22	Radium-228	481681.00	1346319.94
WP-SS-22	Thorium-228	481681.00	1346319.94
WP-SS-22	Thorium-232	481681.00	1346319.94
WP-SS-22	Uranium, Total	481681.00	1346319.94
WP-SS-23	Radium-226	481901.99	1346538.94
WP-SS-23	Radium-228	481901.99	1346538.94
WP-SS-23	Thorium-228	481901.99	1346538.94
WP-SS-23	Thorium-232	481901.99	1346538.94
WP-SS-23	Uranium, Total	481901.99	1346538.94
500318/SS-35	Uranium, Total	479544.93	1346398.61

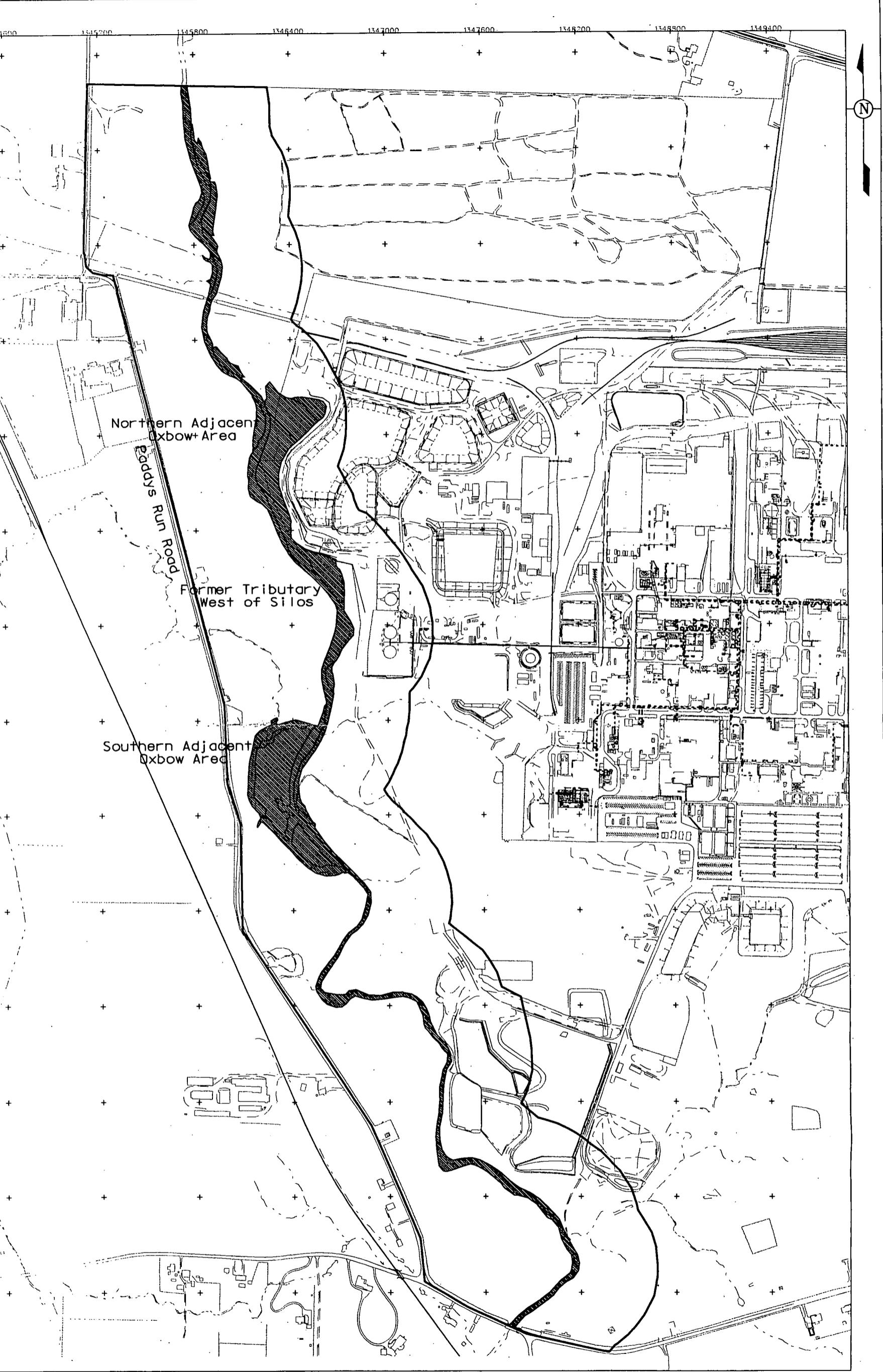
4

000009

1                   **TABLE 1-2**  
 2                   **KEY PERSONNEL**  
 3

Title	Primary	Alternate
DOE Contact	Rob Janke	Kathi Nickel
Project Manager	Tom Crawford	Jyh-Dong Chiou
Characterization Lead	Deanna Diallo	Mike Rolfs
Real-Time Program Manager	Joan White	Dave Allen
RTIMP Field Lead	Brian McDaniel	Dave Allen
Surveying Lead	Jim Schwing	Jim Capannari
Data Management Contact	Deanna Diallo	Mike Rolfs
FACTS/SED Data Management Contact	Sue Schaefer	Krista Blades
WAO Contact	Linda Barlow	TBD
Quality Assurance Contact	Reinhard Friske	Mary Eleton
Safety and Health Contact	Debbie Grant	Phil Thomas

4                   FACTS – Fernald Analytical Computerized Tracking System  
 5                   RTIMP – Real-Time Instrumentation Measurement Program  
 6                   SED – Sitewide Environmental Database  
 7                   WAO – Waste Acceptance Organization  
 8



DRAFT

FIGURE 1-1. LOCATION OF PADDYS RUN

3230

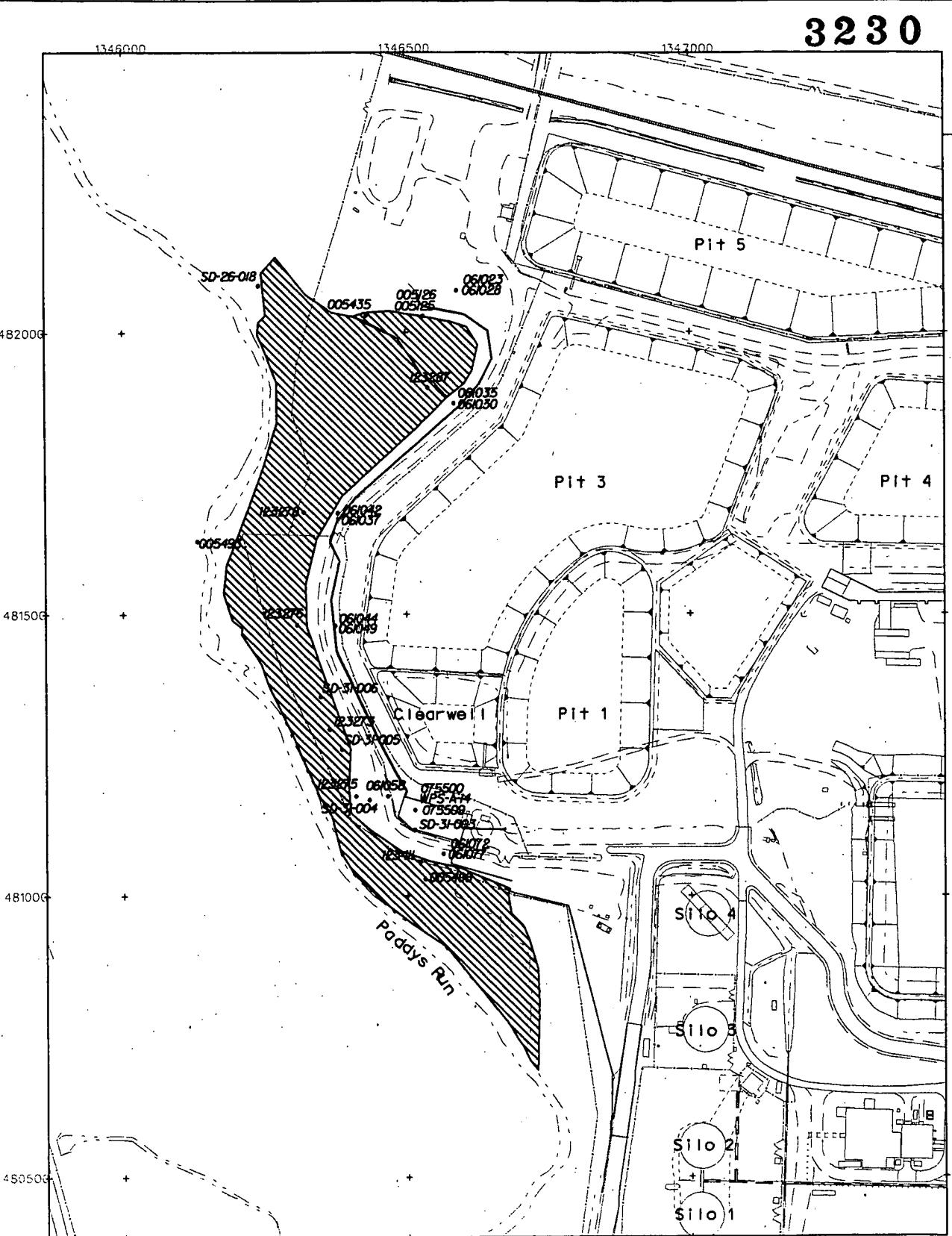
3230



V:\\$50\J31\EDGAR\HISTORICAL\paddys.dgn

STATE PLANAR COORDINATE SYSTEM 1983

27-AUG-2000



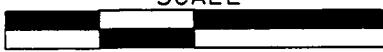
LEGEND:



NORTHERN OXBOW AREA

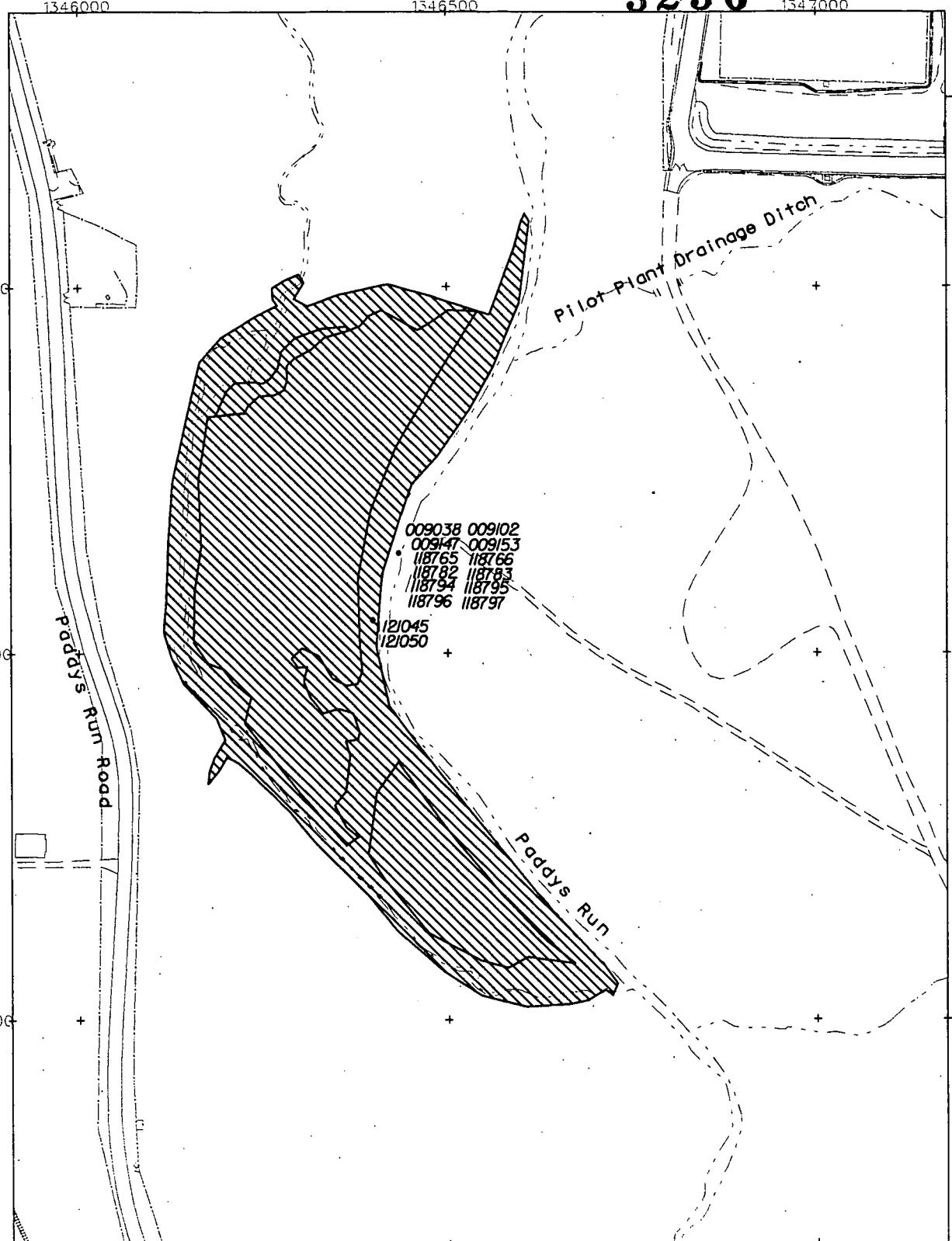
● HISTORICAL SAMPLE LOCATION

SCALE



DRAFT

FIGURE 1-2. HISTORICAL SAMPLE LOCATIONS WITHIN THE NORTHERN OXBOW  
000012

**DRAFT**

• HISTORICAL SAMPLE LOCATION

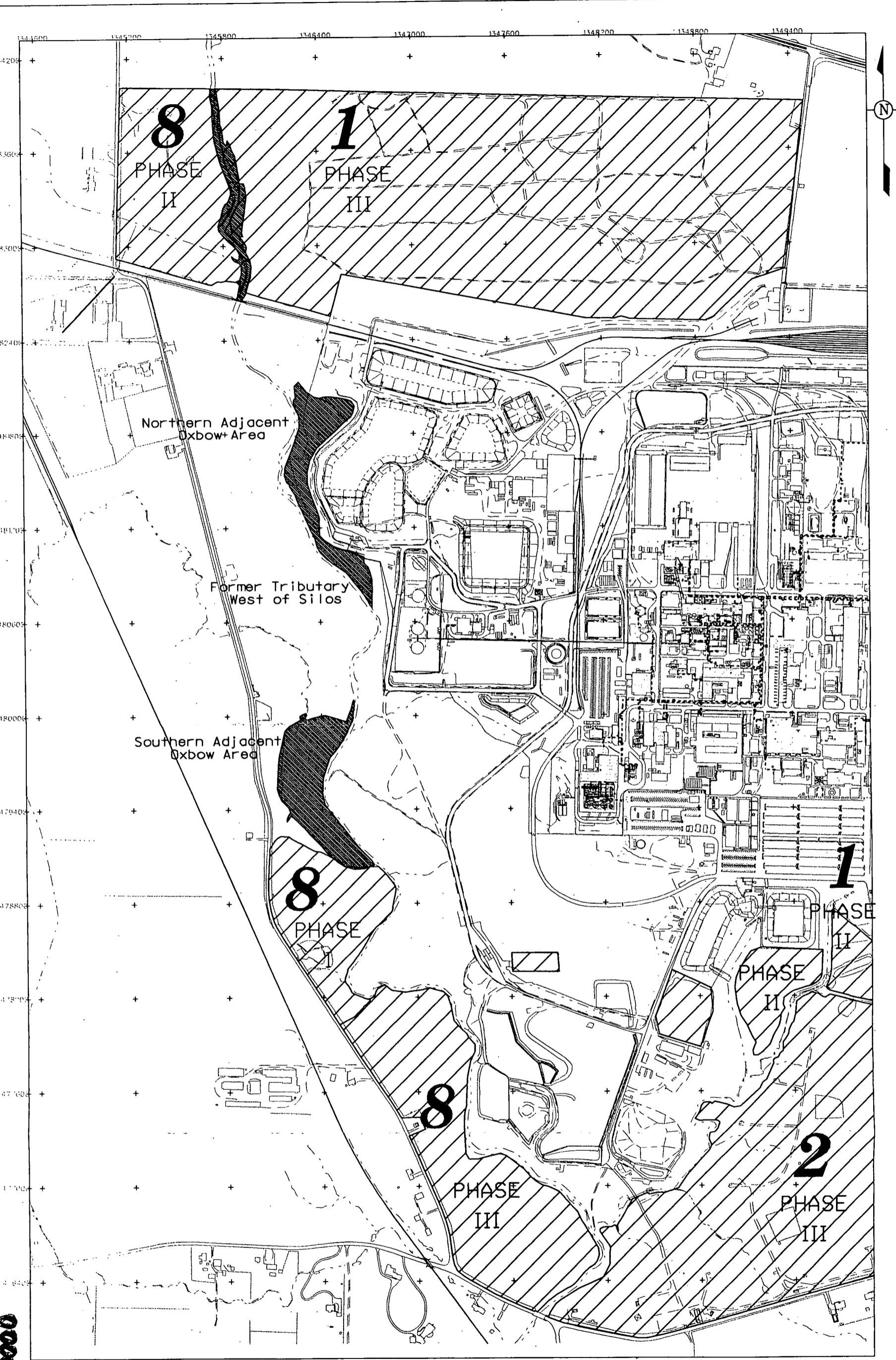
SCALE

200	100	0	200 FEET
-----	-----	---	----------

FIGURE 1-3. HISTORICAL SAMPLE LOCATIONS WITHIN THE SOUTHERN OXBOW

**000013**

0000014



DRAFT

3230

FIGURE 1-4. PRIORITY SCANNING AREAS WITHIN PADDYS RUN

## 2.0 REAL-TIME SCANNING PROGRAM

The real-time scanning of Paddys Run will be conducted when the streambed is dry. Real-time scanning will not be conducted over areas with standing or running water. Prior to scanning, the Characterization Lead or designee will arrange for preparation, clearing, and access controls to the areas.

Most real-time data on Paddys Run will be collected using the high-purity germanium (HPGe) detectors and/or the Gator, due to the steep side banks and rough surface of Paddys Run. The adjacent areas may be scanned using the Radiation Measurement System [Radiation Scanning System (RSS), Radiation Tracking System (RTRAK) and/or the Gator]. Real-time precertification coverage of the area will be as close as possible to 100 percent coverage. Radiation Measurement System (RMS) operations will be performed in accordance with procedure EQT-34, Radiological Scanning System. HPGe detector operations will be consistent with procedure EQT-23, High Purity Germanium Detectors.

Based on results of the real-time measurements, HPGe detectors may be used at lower detection heights to evaluate/confirm concentrations of radium-226, thorium-232, and total uranium. A hot spot is suspected at three times (3x) the FRL with the RMS or 2xFRL with the HPGe. If the suspected hot spot is confirmed (2xFRL with HPGe), hot spot delineation will take place. The real-time equipment and corresponding equipment configurations used are summarized in Table 2-1.

Soil moisture measurements, collected to support scanning activities, will be performed in accordance with procedure EQT-32, Troxler® 3440 Series Surface Moisture/Density Gauge, or EQT-39, Zeltex® Infrared Moisture Meter. Background radon monitoring will also take place in support of all real-time measurements. System calibration operations for HPGe detectors will be performed in accordance with procedure EQT-22, High Purity Germanium Detector In Situ Efficiency Calibration.

### 2.1 INITIAL PRECERTIFICATION SCAN

Initial real-time precertification scanning (Phase I) will consist of the maximum possible coverage of Paddys Run and adjacent areas using real-time, gamma sensitive, RMS detector systems (RTRAK/RSS/Gator) or the HPGe to evaluate soil contamination patterns. Real-time detector system coverage will be limited to the surface soil and will be as extensive as possible without jeopardizing worker safety (i.e., steep slopes). When the HPGe detectors are used for surface scanning, measurements

1 will be obtained at a detector height of 1 meter and a count time of 900 seconds (15 minutes). At the  
2 discretion of the Characterization Lead and/or RTIMP analysts, these readings may be obtained at the  
3 31-centimeter detector height if a smaller field of view is required (i.e., topographic constraints or  
4 avoiding standing water in tributary within the field of view, etc.). At a minimum, the 99.1 percent  
5 coverage option (see Section 4.10 of the User's Manual) will be employed to scan the oxbow areas and  
6 the stream corridor as it becomes bounded by certified areas.

7  
8 Since the historical data in the adjacent oxbow areas show some above-FRL radiological constituents at  
9 the surface, HPGe measurements will be collected at all locations in the oxbow areas which are  
10 above-FRL (Figures 2-1 and 2-2). HPGe measurements at these locations will be collected at the  
11 detector height of 15 cm and a count time of 900 seconds (15 minutes). Based on the results of the  
12 HPGe measurements, further characterization may be necessary. All further characterization of these  
13 areas will be documented in a Variance/Field Change Notice (V/FCN).

14  
15 The RSS will be used in accessible areas. The mobile RMS spectral acquisition time will be set to  
16 4 seconds, and data will be collected with a detector speed of 1 mile per hour. Adjacent passes will be  
17 conducted with approximately a 0.4-meter overlap, which corresponds to a separation of the centerline of  
18 the passes by 2 meters. The onboard Global Positioning System (GPS) will be used to obtain positioning  
19 information (i.e., northings and eastings) for each spectrum acquired.

20  
21 The data obtained from RMS real-time measurements will be used to determine patterns of total gamma  
22 activity and the presence of potential hot spots in Paddys Run and adjacent areas. A 2-point moving  
23 average of consecutive mobile sodium iodide (NaI) measurements will be mapped to determine if total  
24 uranium, radium-226 and/or thorium-232 hot spots are present. After reviewing the mapped data, the  
25 Characterization Lead will determine the HPGe locations for either confirmation/delineation  
26 measurements or highest RMS total gamma activity measurements.

27  
28 **2.1.1 Streambed Spot Checking**

29 While the priority areas are being completed for the initial scan, the streambed will be walked down to  
30 determine field locations for visible debris and spot check real-time measurements.

31

1 As stated in Section 1.3, all visible debris will be scanned using a beta/gamma frisker. All debris with  
2 above-background measurements will be identified for removal. If debris exceeds the health and safety  
3 trigger levels, 5,000 disintegrations per minute (dpm) for fixed beta/gamma contamination or 1,000 dpm  
4 for smearable contamination, a radiological technician and WAO personnel will be contacted for proper  
5 removal. All transite encountered will require removal regardless of the beta/gamma measurements.  
6

7 Real-time spot check locations will be determined in the field based on elevated debris measurements  
8 and/or visual inspection of the streambed. Field locations will be placed as deemed necessary to assist in  
9 determining the extent of contamination.

10

11 **2.2 CONFIRMATION**

12 All confirmation measurements will be taken using HPGe detectors. These measurements will be  
13 obtained to confirm potential hot spots identified by RMS (i.e., 2-point moving average results above  
14 3xFRL) and any HPGe potential hot spots (results above 2xFRL at the 1-meter height), as identified  
15 during the initial real-time scanning.

16

17 Per guidelines established in Section 3.3.2 of the User's Manual, all RMS hot spot confirmation  
18 measurements will be obtained at two different HPGe detector heights: 31 cm (1 foot) and 1 meter. The  
19 spectral acquisition time will be set to 15 minutes for both readings. All HPGe hot spot confirmation  
20 measurements need only a 31-cm detector height measurement (the initial measurement was already  
21 obtained at 1 meter). The spectral acquisition time will also be 15 minutes for this measurement. All  
22 HPGe hot spot confirmation measurement locations will be surveyed and marked, as identified in  
23 Section 2.4. The HPGe Target Analyte List (TAL) is shown in Table 2-2. A hot spot is confirmed if an  
24 HPGe measurement at either detector height exceeds 2xFRL for any area-specific constituents of concern  
25 (ASCOC).

26

27 **2.3 HOT SPOT DELINEATION**

28 If a hot spot is confirmed (i.e., HPGe result above 2xFRL at either detector height), the delineation  
29 approach will be determined by project management after considering all surrounding real-time results.  
30 However, the strategy must be consistent with guidelines documented in Section 3.3.3 of the User's  
31 Manual (detector height of 15 cm, count time of 15 minutes). Hot spot pre- and post-excavation  
32 real-time measurements will include elevation coordinates. Details of the hot spot delineation will be

1 documented in a V/FCN. This information and data will also be forwarded to WAO (via Data Group  
2 Form FS-F-5157) for waste tracking.

3

4 **2.4 MEASUREMENT IDENTIFICATION**

5 All measurements will be assigned a unique identification for data tracking purposes. All data files will  
6 include the area in the file names. All measurements will contain some or all of the following  
7 designators.

8

9 **Scanning:**

- 10 1. Prefix designating the location: Paddys Run = PR
- 11 2. Number designating the section: S = stream bed corridor  
NOX = northern oxbow area along the Waste Pits  
SOX = southern oxbow area along A8PI and A8PIII
- 12 3. RSS batch number  
(if applicable): Sequential numbering of RSS analytical runs
- 13 4. HPGe Measurement Number  
(if applicable): Designates the sequential numbering of HPGe  
measurements. The first measurement taken is 1 and  
any subsequent measurements are numbered  
sequentially (2, 3, 4, etc.).
- 14 5. HPGe Measurement designator  
(if applicable): G = gamma measurements
- 15 6. Quality control designator: D = duplicate measurement  
Note: One duplicate HPGe measurement will be  
collected per 20 measurements

16

17 **For example:**

18 PR-NOX-1-G-D PR-S-521

19 Where: PR = Paddys Run Where: PR = Paddys Run  
20 NOX = northern oxbow area along the waste pits S = stream bed corridor  
21 1 = the first gamma reading obtained 521 = sequential RSS run  
22 G = gamma measurement  
23 D = duplicate measurement

Spot Check Investigation

1. Prefix designating the location: Paddys Run = PR
2. Number designating the purpose: S = stream bed corridor  
NOX = northern oxbow area along the Waste Pits  
SOX = southern oxbow area along A8PI and A8PIII
3. Investigation identifier: INV = investigation
4. Batch number (if applicable): Sequential numbering of RMS analytical runs
5. Sequential location number with the detector height (if applicable) Sequential numbering 1 through x  
Detector height - A = 1 meter  
B = 31 cm  
C = 15 cm  
(ex. 1A or 1B)
6. Measurement designator: G = gamma measurements
7. Quality control designator: D = duplicate measurement

Confirmation:

1. Prefix designating the location: Paddys Run = PR
2. Number designating the purpose: S = stream bed corridor  
NOX = northern oxbow area along the Waste Pits  
SOX = southern oxbow area along A8PI and A8PIII
3. Confirmation identifier: CN = confirmation
4. Sequential location number with the detector height: Sequential numbering 1 through x  
Detector height - A = 1 meter  
B = 31 cm  
C = 15 cm  
(ex. 1A or 1B)
5. Measurement designator: G = gamma measurements
6. Quality control designator: D = duplicate measurement

1 For example:

2                   PR-S-CN-1A-G-D

3                   Where: PR = Paddys Run  
4                                 S = stream bed corridor  
5                                 CN = Confirmation measurement  
6                                 1A = the first gamma reading obtained and at a detector height of 1 meter  
7                                 G = gamma measurement  
8                                 D = duplicate measurement

9                   Hot Spot Delineation:

- 10                  1. Prefix designating the location: PR = Paddys Run  
11                  2. Letter designating the purpose: HS = Hot Spot  
12                  3. Sequential location number: Sequential numbering 1 through x  
13                  4. Hot Spot post removal measurement (if applicable): Alpha numerically listed (A, B, C, etc.)  
14                  5. Measurement designator: G = gamma measurements  
15                  6. Quality control designator: D = duplicate measurement

16                   Example:

17                   PR-HS-4-A-G-D

18                   Where: PR = Paddys Run  
19                                 HS = Hot Spot  
20                                 4 = the fourth hot spot delineation  
21                                 A = the first measurement after hot spot removal  
22                                 G = gamma measurement  
23                                 D = duplicate measurement

24                   Radon Monitoring Measurement Designation:

- 25                  1. Prefix designating the location: PR = Paddys Run  
26                  2. Monitoring activity: RADON = Radon monitoring  
27                  3. Detector Height:  
28                                 A = 1 meter  
29                                 B = 31 cm  
30                                 C = 15 cm

1       4. Sequential numbering of radon  
2                   monitoring:                           1, 2, 3, etc.  
3

4       For example:

5                   PR-RN-A-1

6       Where: PR = Paddys Run  
7                   RADON = Radon monitoring  
8                   A = 1 meter  
9                   1 = first radon monitoring event  
10

## 11      2.5 DATA MAPPING

12     As the Survey and RTIMP Teams acquire measurements, the data will be electronically loaded into  
13     mapping software through manual file transfer or Ethernet. A set of maps or HPGe data summary  
14     printouts will be generated for the RTIMP and Characterization Lead or designees. Maps will be  
15     generated depicting the following, unless otherwise specified by the Characterization Lead or designee:  
16

### 17      Surface Scan Coverage Map(s)

- 19       • RMS Location Map (colored squares) - indicating batch numbers  
20
- 21       • RMS Total Activity Map (single spectra coverage) - to determine certification unit (CU)  
22                   boundaries  
23
- 24       • Constituents of Concern (COCs) Concentration Maps - radium-226 and thorium-232  
25                   (2-point running average to determine potential hot spots exceeding 3xFRL) depicting  
26                   1xFRL, 2xFRL, and 3xFRL concentrations in all areas  
27
- 28       • HPGe Location Map (bubble map showing field of view and number for each HPGe  
29                   measurement) - including summary data printout for each HPGe measurement.  
30

31     Note: HPGe location map can be combined with the previous maps if needed.  
32

### 33      HPGe Confirmation/Delineation Map(s)

- 35       • HPGe Location Map (bubble map showing field of view and number for each HPGe  
36                   measurement) - including summary data printout for each HPGe measurement  
37

### 38      Hot Spot Post Removal Map(s)

- 40       • HPGe Location Map (bubble map showing field of view and number for each HPGe  
41                   measurement) - including summary data printout for each HPGe measurement  
42

1 The map and/or HPGe data summary printouts will be used to provide the Characterization Lead or  
2 designee with information to determine if additional scanning, confirmation, or delineation  
3 measurements are required.

4

5 **2.6 SURFACE SOIL MOISTURE MEASUREMENTS**

6 Surface moisture measurements will be collected to determine soil moisture content and used to correct  
7 the real-time data so it is comparable to a lab analysis (where data is reported on a dry weight basis).

8 Moisture measurements can be collected using either the Troxler® gauge or Zeltex® moisture meter.

9 Surface moisture measurements will be obtained at a minimum of two per acre where the mobile RMS  
10 detectors were used for the real-time scan. When the HPGe is used, one surface moisture measurement  
11 will be obtained per HPGe reading. All surface moisture measurements will be conducted within 8 hours  
12 of collecting the real-time measurements and before ambient weather conditions change. When using  
13 the Troxler® gauge, technicians cannot collect the moisture measurements simultaneously with the RMS  
14 or HPGe measurements because internal radioactive sources contained in the moisture gauge can cause  
15 interference with the HPGe or RMS measurements. If surface soil conditions are unsuitable for moisture  
16 measurements, a default moisture value may be used. Refer to Section 3.8 of the User's Manual for more  
17 information on these measurements.

18

19 **2.7 BACKGROUND RADON MONITORING**

20 Background radon monitoring will be utilized during the collection of real-time measurements to obtain  
21 background radon information from the time that data collection begins until after the final measurement  
22 is completed. The monitor will be placed in one location for the day, where it will be set at the same  
23 height as the detector being used to collect the soil radiation measurements (ex. RMS detector height =  
24 31 cm). The radon monitor must also be placed at approximately the same elevation as the real-time  
25 measurement. The background radon data will be used per Section 5.3 of the User's Manual to correct  
26 the radium-226 data.

27

28 **2.8 PHYSICAL SAMPLES**

29 Physical samples may be taken under this PSP in areas inaccessible to both the NaI systems and the  
30 HPGe detectors and/or for delineation purposes. The Characterization Lead or designee will document  
31 the sampling approach in a V/FCN. If collected, physical samples will follow the DQOs identified in  
32 DQO SL-048.

2.9 WASTE DISPOSITION

- 1    2.9 WASTE DISPOSITION
- 2    All waste disposition of debris or soil determined to be above-FRL will be managed in accordance with a
- 3    Project Waste Identification and Disposition 461 report, if needed.

1  
2  
3  
**TABLE 2-1**  
**REAL-TIME EQUIPMENT AND DETECTOR CONFIGURATIONS**

Phase	Equipment Used	Detector Configuration
Scanning	RMS	Speed = 1 mph, Acquisition Time = 4 seconds
	HPGe	Height = 1 m, Acquisition Time = 15 minutes
Confirmation	HPGe	Height = 1 m, Acquisition Time = 15 minutes for RMS scan derived locations; or Height = 31 cm, Acquisition Time = 15 minutes for HPGe scan derived locations.
Hot Spot Delineation	HPGe	Height = 15 cm, Acquisition Time = 15 minutes

1  
2  
3  
4  
5  
6  
**TABLE 2-2**  
**TARGET ANALYTE LIST FOR**  
**PADDYS RUN HPGe SCANNING****TAL A2P1-PRECERT-A**

<b>HPGe Detector Scanning</b>		
1	ASL A	Total Uranium (OU5 FRL = 82 mg/kg)
2	ASL A	Thorium-228 (FRL = 1.7 pCi/g)
3	ASL A	Thorium-232 (FRL = 1.5 pCi/g)
4	ASL A	Radium-226 (FRL = 1.7 pCi/g)
5	ASL A	Radium-228 (FRL = 1.8 pCi/g)

7  
8 ASL - analytical support level  
9 mg/kg - milligrams per kilogram  
10 pCi/g - picoCuries per gram

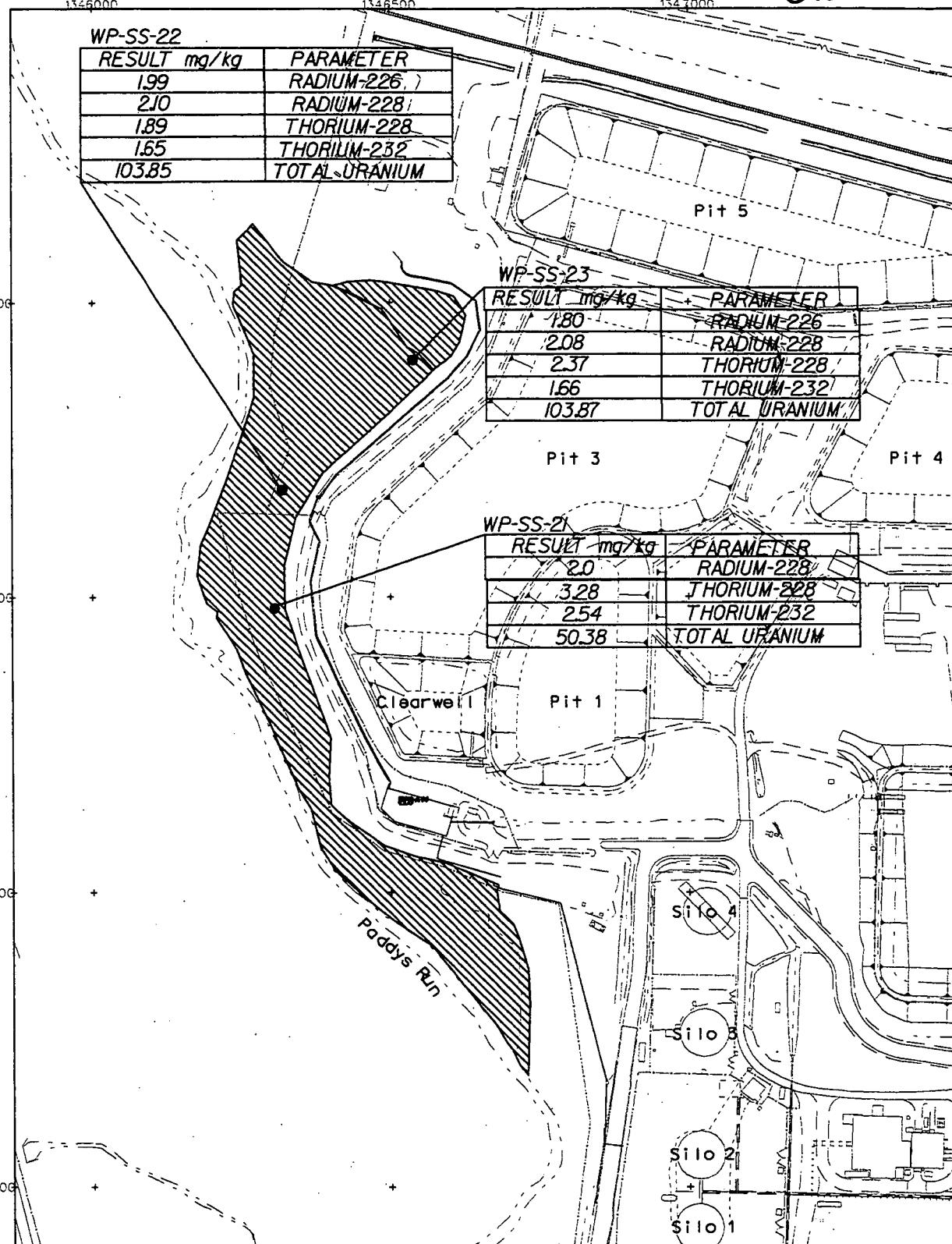
3230

N

V:\#50\J31\kg\m\wp\paddy7.dgn

STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

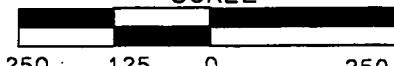
LEGEND:

NORTHERN OXBOW AREA



ABOVE FRL SAMPLE LOCATION

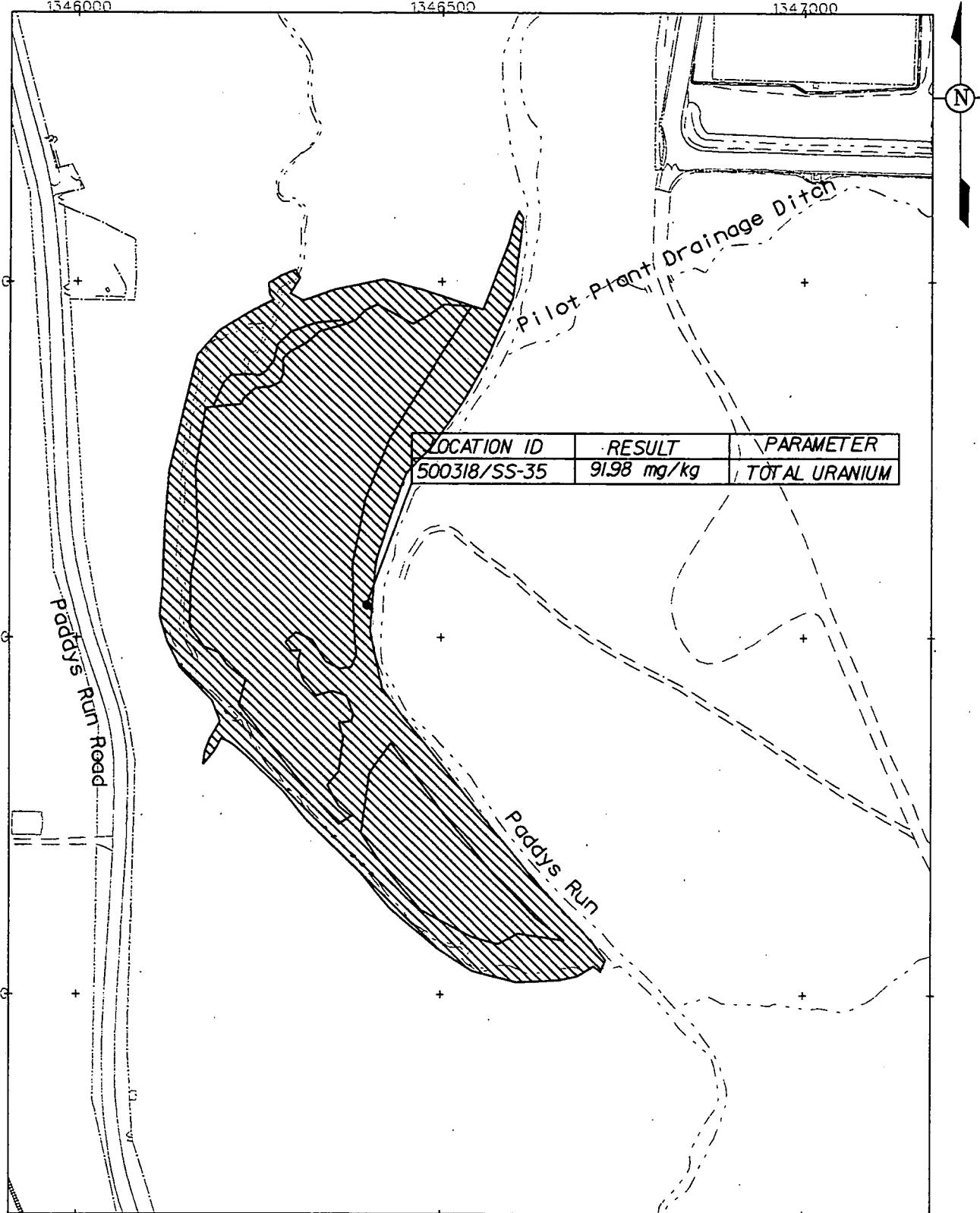
SCALE



DRAFT

FIGURE 2-1. ABOVE FRL RADIOLOGICAL LOCATIONS IN NORTHERN OXBOW AREA

000026

LEGEND:

SOUTHERN OXBOW AREA

• ABOVE FRL SAMPLE LOCATION

SCALE



DRAFT

FIGURE 2-2. ABOVE FRL RADIOLOGICAL LOCATION IN SOUTHERN OXBOW AREA

000027

1           **3.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS**

2

3           **3.1 QUALITY CONTROL MEASUREMENTS**

4           In accordance with DQO SL-056, Revision 0 (Appendix B), all real-time measurements will be classified  
5           as ASL A. Per the User's Manual, HPGe duplicate readings will be taken at a frequency of one for every  
6           20 measurements.

7

8           **3.2 PROJECT REQUIREMENTS FOR SURVEILLANCES**

9           Project management has ultimate responsibility for the quality of the work processes and the results of  
10          the scanning activities covered by this PSP. The FEMP Quality Assurance (QA) organization may  
11          conduct independent assessments of the work process and operations to assure the quality of  
12          performance. The assessment encompasses technical and procedural requirements of this PSP and the  
13          SCQ. Independent assessments may be performed by conducting surveillances.

14

15          **3.3 FIELD CHANGES TO THE PSP**

16          If field conditions require changes or variances, written approval must be obtained from the  
17          Characterization Lead and QA before changes are implemented (electronic mail is acceptable). Changes  
18          to the PSP will be noted in the applicable Field Activity Logs and on a V/FCN. QA must receive the  
19          completed V/FCN, with the signatures of the Project Manager, Characterization Lead and the QA  
20          Representative or designee, within seven working days of granting approval. If a V/FCN is generated to  
21          delineate or confirm a hot spot location with soil samples, WAO approval must also be obtained.

22

23          **3.4 TRAINING**

24          Programs supporting this work are responsible for ensuring that team members work to and are trained to  
25          applicable documents. Additionally, programs supporting this work are responsible for ensuring team  
26          members in their organizations are qualified and maintain qualification for site access requirements. The  
27          project manager will be responsible for ensuring any project specific training required to perform work  
28          per this PSP is conducted.

**4.0 SAFETY AND HEALTH**

1

2

3 Personnel will conform to precautionary surveys by FEMP personnel representing the Utility Engineer,  
4 Industrial Hygiene, Occupational Safety, and Radiological Control.

5

6 All work performed on this project will be performed in accordance to applicable Environmental  
7 Monitoring project procedures, Radiological Control Requirements Manual (RM-0021), Safety  
8 Performance Requirements Manual, Fluor Fernald work permit, radiological work permits, penetration  
9 permits, and other applicable permits. Concurrence with all applicable safety permits is required from all  
10 personnel in the performance of their assigned duties.

11

12 All personnel involved in the collection of soil samples will be briefed on this PSP and the briefing will  
13 be documented. Personnel who do not receive a briefing on these requirements will not participate in the  
14 execution of soil sampling activities related to the completion of assigned project responsibilities.

15

16 **All emergencies shall be reported immediately on extension 911, or to the Site Communications**  
17 **Center at 648-6511 (if using a cellular phone), or by using a radio and contacting "CONTROL" on**  
18 **Channel 11.**

## 5.0 DATA MANAGEMENT

The RTIMP group will provide hard copy maps and/or summary reports to the Characterization Lead and Data Management Lead or designees. All real-time data will be collected and reported at a minimum ASL A and require no data validation. Any physical samples measurements will be collected and reported at ASL B and will require 10 percent data validation/100 percent field validation. All electronically recorded field data will have the RMS or HPGe Data Verification Checklist (Section 5.4 of the User's Manual), which will be completed after each data collection event. Field documentation, such as the Nuclear Field Density/Moisture Worksheet, will undergo an internal review by the RTIMP.

Electronically recorded data from the GPS, HPGe, and RMS systems will be downloaded on a daily basis to disks, or to the Local Area Network (LAN) using the Ethernet connection. The Characterization Lead or designee will be informed by the RTIMP Lead or designee when RTIMP measurements do not meet data quality control checklist criteria. The Characterization Lead or designee will determine whether additional scanning, confirmation, or delineation measurements are required.

Once the electronic data have been placed on the LAN and SED, the Data Management Lead will perform an evaluation prior to placement on the Soil and Disposal Facility Project (SDFP) web site. The evaluation may involve a comparison check between the electronic data, hard copy maps and summary reports for accuracy and completeness. The evaluation will be documented on the Real-Time Electronic Data Quality Control Checklist (Figure 5-1), dated and signed. After confirmed and delineated hot spot data (requiring remediation) are entered in the SED, the Data Group Form (FS-F-5157) and Excavation Monitoring Form will be completed by the Characterization Lead or designee with concurrence from a WAO representative. The original Data Group Form will be maintained in WAO project files.

Copies of field documentation shall be generated and provided to the Characterization Lead or Data Management Lead upon request and maintained in SDFP project files until dispositioned to Engineering/Construction Document Control (ECDC). RTIMP will maintain all the real-time files and survey data will be maintained by the Survey Lead or designee. All records associated with this PSP will reference the PSP number and eventually be forwarded to ECDC to be placed in the project file.

PSP/Project #: \_\_\_\_\_

Batch Numbers: \_\_\_\_\_

HPGe file Numbers: \_\_\_\_\_

**REAL-TIME ELECTRONIC  
DATA QUALITY CONTROL CHECKLIST**

**3230**

#	ITEM TO BE CHECKED	✓ or No	Modification/Correction with explanation	Date Corrected
1	Receive the Characterization Request form, Monitoring Form (MF), coverage maps, real-time verification checklist, and/or HPGe parameter summary report from the Characterization field personnel			
2	Verify the signatures and all blanks on the MF are complete through Section 6 and complete on the Real-Time Verification Checklist			
3	Check loader to ensure the data transferred from the LAN to the SED (if the data files are in the SED, the loader is working properly)			
4	Check to ensure data transferred into the correct fields by looking at the data on the LAN in comparison with the data transferred to the SED (to verify this, all data fields for a few runs in each file will be reviewed)			
5	Check that the project number is correct and is consistent on the MF, the LAN, and the SED in both the worksheet files and the results/data files			
6	Check that the MF, the LAN, and the SED have the correct location identifier in both the worksheet files and the results/data files			
7	Check that worksheet on the LAN and in the SED have the correct elevation documented from the surveying group			
8	Verify northing and easting coordinates, look at the plotted map and the coordinates in the SED and verify the coordinates are within the boundary on the plotted map			
9	Check data files to ensure all files are received			
10	Attach this checklist and documentation for modifications to the EMF, initial and date all forms and documentation		X	
11	Insert USE into the "QC Field" on the SED after all this has been checked and verified correct		X	X

FIGURE 5-1

Sign and Date \_\_\_\_\_

000031

PSP/Project #: \_\_\_\_\_

Batch Numbers: \_\_\_\_\_

HPGe file Numbers: \_\_\_\_\_

1. If no, check with the Characterization Lead or designee to get needed forms.
2. If no, contact Characterization Lead and return MF to be completed and/or signed.
3. If no, check with SED Database Manager (ext. 7544) to find out why.
4. If no, check with the Real-Time Field Lead to see if any additional fields were added. If so, call SED Database Manager (ext. 7544) to have the field added into the SED tables. If not, check with SED Database Manager (ext. 7544) to see why the fields loaded incorrectly.
5. If no, verify the correct project number with the Characterization Lead and insert the project number into the worksheet on the LAN and the worksheet in the SED; attach the documentation to the form.
6. If no, verify with the Characterization Lead the correct identifier and correct the identifier both in the worksheet on the LAN and in the SED; attach the documentation to the form.
7. If no, check with the Surveying group to verify the elevation; If incorrect, change the elevation in the worksheet on the LAN and in the SED and attach the documentation to the form.
8. If no, check with Characterization Lead or designee to resolve the problem.
9. Run query in SED. The number of RTRAK/RSS files can be checked with the number of records (files) listed in the SRDIG directory under Real-Time Lab View files. No sequential gaps are anticipated; if gaps are found, check with the Real-Time Field Lead. The Real-Time Field Lead will verify gaps or will investigate to find out why the files are missing. For HPGe shots, an HPGe Data Verification Checklist is attached to the MF listing all the files. This Checklist can be used to ensure all the files were received in the SED.

FIGURE 5-1

Sign and Date \_\_\_\_\_

**1           6.0 APPLICABLE DOCUMENTS, METHODS, AND STANDARDS**

2  
3     Work performed under this PSP will be conducted in accordance with the following procedures and  
4     documents:

- 5
- 6       • ADM-16, In-Situ Gamma Spectrometry Quality Control
  - 7       • ADM-17, In-Situ Gamma Spectrometry Data Management
  - 8       • ADM-18, Gamma Vision Software for In-Situ Gamma Spectrometry
  - 9       • ADM-19, In-Situ Gamma Spectrometry Prerequisites
  - 10      • EQT-05, Geodimeter® 4000 Surveying System
  - 11      • EQT-10, AC Portable Generator
  - 12      • EQT-22, High Purity Germanium Detector In-Situ Efficiency Calibration
  - 13      • EQT-23, High Purity Germanium Detectors
  - 14      • EQT-32, Troxler® 3440 Series Surface Moisture/Density Gauge
  - 15      • EQT-33, Real-time Differential Global Positioning System Operation
  - 16      • EQT-34, Radiation Scanning System
  - 17      • EQT-39, Zeltex® Infrared Moisture Meter
  - 18      • EQT-41, Radiation Measuring Systems
  - 19      • RM-0021, Radiological Control Requirements Manual
  - 20      • Sitewide Excavation Plan
  - 21      • Sitewide CERCLA Quality Assurance Project Plan (SCQ)
  - 22      • User Guidelines, Measurement Strategies, and Operational Factors for Deployment of
  - 23      In-Situ Gamma Spectrometry at the Fernald Site (User's Manual)
  - 24
  - 25      • Radiation Tracking System (RTRAK) Applicability Study
  - 26
  - 27      • Calibration Report for the Mobile Sodium Iodide System Known as the Gator

**3230**

**APPENDIX A**

**HISTORICAL DATA FOR ADJACENT OXBOW AREAS**

**000034**

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
1,1,2-Trichloroethane	Unknown	061077	481074.26	1346563.08	6 U		ug/kg	1.5	2
1,1,2-Trichloroethane	Unknown	061028	482073.77	1346590.37	6 U		ug/kg	1.5	2
1,1,2-Trichloroethane	Unknown	061035	481873.87	1346584.87	6 U		ug/kg	1.5	2
1,1,2-Trichloroethane	Unknown	061042	481679.46	1346379.58	6 U		ug/kg	1.5	2
1,1,2-Trichloroethane	Unknown	061049	481479.56	1346374.08	6 U		ug/kg	1.5	2
1,1,2-Trichloroethane	RI/FS	123411	481060.07	1346522.41	11 U		ug/kg	0	0.5
1,1,2-Trichloroethane	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
1,1,2-Trichloroethane	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
1,1,2-Trichloroethane	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
1,1,2-Trichloroethane	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
1,1,2-Trichloroethane	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
1,1-Dichloroethene	Unknown	061077	481074.26	1346563.08	6 U		ug/kg	1.5	2
1,1-Dichloroethene	Unknown	061028	482073.77	1346590.37	6 U		ug/kg	1.5	2
1,1-Dichloroethene	Unknown	061035	481873.87	1346584.87	6 U		ug/kg	1.5	2
1,1-Dichloroethene	Unknown	061042	481679.46	1346379.58	6 U		ug/kg	1.5	2
1,1-Dichloroethene	Unknown	061049	481479.56	1346374.08	6 U		ug/kg	1.5	2
1,1-Dichloroethene	RI/FS	123411	481060.07	1346522.41	11 U		ug/kg	0	0.5
1,1-Dichloroethene	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
1,1-Dichloroethene	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
1,1-Dichloroethene	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
1,1-Dichloroethene	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
1,1-Dichloroethene	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
1,2-Dichloroethene (Total)	Unknown	061077	481074.26	1346563.08	6 U		ug/kg	1.5	2
1,2-Dichloroethene (Total)	Unknown	061028	482073.77	1346590.37	6 U		ug/kg	1.5	2
1,2-Dichloroethene (Total)	Unknown	061035	481873.87	1346584.87	6 U		ug/kg	1.5	2
1,2-Dichloroethene (Total)	Unknown	061042	481679.46	1346379.58	6 U		ug/kg	1.5	2
1,2-Dichloroethene (Total)	Unknown	061049	481479.56	1346374.08	6 U		ug/kg	1.5	2
1,2-Dichloroethene (Total)	RI/FS	123411	481060.07	1346522.41	11 U		ug/kg	0	0.5
1,2-Dichloroethene (Total)	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
1,2-Dichloroethene (Total)	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
1,2-Dichloroethene (Total)	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
1,2-Dichloroethene (Total)	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
1,2-Dichloroethene (Total)	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
3,3'-Dichlorobenzidine	RI/FS	123275	481177.02	1346409.88	360 UJ		ug/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
3,3'-Dichlorobenzidine	RI/FS	123273	481295.48	1346363.17	370	UJ	ug/kg	0	0.5
3,3'-Dichlorobenzidine	RI/FS	123411	481060.07	1346522.41	380	UJ	ug/kg	0	0.5
3,3'-Dichlorobenzidine	RI/FS	123276	481481	1346307	390	UJ	ug/kg	0	0.5
3,3'-Dichlorobenzidine	RI/FS	123287	481902	1346539	540	UJ	ug/kg	0	0.5
3,3'-Dichlorobenzidine	Unknown	061077	481074.26	1346563.08	780	UJ	ug/kg	1.5	2
3,3'-Dichlorobenzidine	Unknown	061028	482073.77	1346590.37	790	U	ug/kg	1.5	2
3,3'-Dichlorobenzidine	Unknown	061049	481479.56	1346374.08	800	U	ug/kg	1.5	2
3,3'-Dichlorobenzidine	Unknown	061042	481679.46	1346379.58	810	UJ	ug/kg	1.5	2
3,3'-Dichlorobenzidine	Unknown	061035	481873.87	1346584.87	870	U	ug/kg	1.5	2
3,3'-Dichlorobenzidine	RI/FS	123278	481681	1346320	920	UJ	ug/kg	0	0.5
4-Methyl-2-pentanone	RI/FS	123275	481177.02	1346409.88	11	U	ug/kg	0	0.5
4-Methyl-2-pentanone	RI/FS	123273	481295.48	1346363.17	11	U	ug/kg	0	0.5
4-Methyl-2-pentanone	RI/FS	123276	481481	1346307	11	U	ug/kg	0	0.5
4-Methyl-2-pentanone	RI/FS	123411	481060.07	1346522.41	11	UJ	ug/kg	0	0.5
4-Methyl-2-pentanone	Unknown	061077	481074.26	1346563.08	12	U	ug/kg	1.5	2
4-Methyl-2-pentanone	Unknown	061028	482073.77	1346590.37	12	U	ug/kg	1.5	2
4-Methyl-2-pentanone	Unknown	061042	481679.46	1346379.58	12	U	ug/kg	1.5	2
4-Methyl-2-pentanone	Unknown	061049	481479.56	1346374.08	12	U	ug/kg	1.5	2
4-Methyl-2-pentanone	Unknown	061035	481873.87	1346584.87	13	U	ug/kg	1.5	2
4-Methyl-2-pentanone	RI/FS	123287	481902	1346539	16	U	ug/kg	0	0.5
4-Methyl-2-pentanone	RI/FS	123278	481681	1346320	28	U	ug/kg	0	0.5
4-Nitroaniline	Unknown	061028	482073.77	1346590.37	1900	U	ug/kg	1.5	2
4-Nitroaniline	Unknown	061049	481479.56	1346374.08	1900	U	ug/kg	1.5	2
4-Nitroaniline	Unknown	061077	481074.26	1346563.08	1900	UJ	ug/kg	1.5	2
4-Nitroaniline	Unknown	061042	481679.46	1346379.58	2000	UJ	ug/kg	1.5	2
4-Nitroaniline	Unknown	061035	481873.87	1346584.87	2100	U	ug/kg	1.5	2
Acetone	RI/FS	123411	481060.07	1346522.41	11	U	ug/kg	0	0.5
Acetone	RI/FS	123275	481177.02	1346409.88	11	U	ug/kg	0	0.5
Acetone	RI/FS	123273	481295.48	1346363.17	11	U	ug/kg	0	0.5
Acetone	RI/FS	123276	481481	1346307	11	U	ug/kg	0	0.5
Acetone	Unknown	061077	481074.26	1346563.08	12	UJ	ug/kg	1.5	2
Acetone	Unknown	061028	482073.77	1346590.37	12	UJ	ug/kg	1.5	2
Acetone	Unknown	061042	481679.46	1346379.58	12	UJ	ug/kg	1.5	2
Acetone	Unknown	061035	481873.87	1346584.87	13	UJ	ug/kg	1.5	2

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Acetone	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
Acetone	Unknown	061049	481479.56	1346374.08	29 U		ug/kg	1.5	2
Acetone	RI/FS	123278	481681	1346320	160 -		ug/kg	0	0.5
Antimony	Unknown	061072	481074.26	1346563.08	20.3 J		mg/kg	0	0.5
Antimony	Unknown	061030	481873.87	1346584.87	21.3 J		mg/kg	0	0.5
Antimony	Unknown	061037	481679.46	1346379.58	22.7 J		mg/kg	0	0.5
Antimony	Unknown	061023	482073.77	1346590.37	27.8 J		mg/kg	0	0.5
Antimony	Unknown	061058	481176.96	1346465.78	28 J		mg/kg	0	0.5
Antimony	Unknown	061044	481479.56	1346374.08	29.5 J		mg/kg	0	0.5
Aroclor-1254	Unknown	061044	481479.56	1346374.08	64 J		ug/kg	0	0.5
Aroclor-1254	Unknown	061037	481679.46	1346379.58	180 U		ug/kg	0	0.5
Aroclor-1254	Unknown	061072	481074.26	1346563.08	190 U		ug/kg	0	0.5
Aroclor-1254	Unknown	061023	482073.77	1346590.37	200 U		ug/kg	0	0.5
Aroclor-1254	Unknown	061030	481873.87	1346584.87	200 U		ug/kg	0	0.5
Aroclor-1254	Unknown	061058	481176.96	1346465.78	200 U		ug/kg	0	0.5
Aroclor-1260	Unknown	061037	481679.46	1346379.58	180 U		ug/kg	0	0.5
Aroclor-1260	Unknown	061072	481074.26	1346563.08	190 U		ug/kg	0	0.5
Aroclor-1260	Unknown	061044	481479.56	1346374.08	190 U		ug/kg	0	0.5
Aroclor-1260	Unknown	061023	482073.77	1346590.37	200 U		ug/kg	0	0.5
Aroclor-1260	Unknown	061030	481873.87	1346584.87	200 U		ug/kg	0	0.5
Aroclor-1260	Unknown	061058	481176.96	1346465.78	200 U		ug/kg	0	0.5
Arsenic	RI/FS	123278	481681	1346320	1 UJ		mg/kg	0	0.5
Arsenic	RI/FS	123275	481177.02	1346409.88	2.6 UJ		mg/kg	0	0.5
Arsenic	RI/FS	123273	481295.48	1346363.17	3.2 J		mg/kg	0	0.5
Arsenic	Unknown	061072	481074.26	1346563.08	3.5 J		mg/kg	0	0.5
Arsenic	Unknown	061058	481176.96	1346465.78	3.9 J		mg/kg	0	0.5
Arsenic	Unknown	061030	481873.87	1346584.87	4.2 J		mg/kg	0	0.5
Arsenic	Unknown	061037	481679.46	1346379.58	4.2 J		mg/kg	0	0.5
Arsenic	Unknown	061044	481479.56	1346374.08	4.5 J		mg/kg	0	0.5
Arsenic	RI/FS	123411	481060.07	1346522.41	5.2 J		mg/kg	0	0.5
Arsenic	RI/FS	123276	481481	1346307	6.2 J		mg/kg	0	0.5
Arsenic	Unknown	061023	482073.77	1346590.37	6.4 J		mg/kg	0	0.5
Arsenic	RI/FS	123287	481902	1346539	13.5 J		mg/kg	0	0.5
Barium	Unknown	061037	481679.46	1346379.58	27.2 -		mg/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Barium	RI/FS	123273	481295.48	1346363.17	29.5	-	mg/kg	0	0.5
Barium	RI/FS	123278	481681	1346320	36.5	J	mg/kg	0	0.5
Barium	RI/FS	123275	481177.02	1346409.88	42.1	-	mg/kg	0	0.5
Barium	Unknown	061072	481074.26	1346563.08	48.2	-	mg/kg	0	0.5
Barium	RI/FS	123411	481060.07	1346522.41	48.7	-	mg/kg	0	0.5
Barium	Unknown	061044	481479.56	1346374.08	49.9	-	mg/kg	0	0.5
Barium	Unknown	061058	481176.96	1346465.78	51.9	-	mg/kg	0	0.5
Barium	Unknown	061023	482073.77	1346590.37	52.5	-	mg/kg	0	0.5
Barium	Unknown	061030	481873.87	1346584.87	64.7	-	mg/kg	0	0.5
Barium	RI/FS	123276	481481	1346307	64.9	-	mg/kg	0	0.5
Barium	RI/FS	123287	481902	1346539	123	-	mg/kg	0	0.5
Benzene	Unknown	061077	481074.26	1346563.08	6	U	ug/kg	1.5	2
Benzene	Unknown	061028	482073.77	1346590.37	6	U	ug/kg	1.5	2
Benzene	Unknown	061035	481873.87	1346584.87	6	U	ug/kg	1.5	2
Benzene	Unknown	061042	481679.46	1346379.58	6	U	ug/kg	1.5	2
Benzene	Unknown	061049	481479.56	1346374.08	6	U	ug/kg	1.5	2
Benzene	RI/FS	123411	481060.07	1346522.41	11	U	ug/kg	0	0.5
Benzene	RI/FS	123275	481177.02	1346409.88	11	U	ug/kg	0	0.5
Benzene	RI/FS	123273	481295.48	1346363.17	11	U	ug/kg	0	0.5
Benzene	RI/FS	123276	481481	1346307	11	U	ug/kg	0	0.5
Benzene	RI/FS	123287	481902	1346539	16	U	ug/kg	0	0.5
Benzene	RI/FS	123278	481681	1346320	28	U	ug/kg	0	0.5
Benzo(a)anthracene	RI/FS	123287	481902	1346539	99	J	ug/kg	0	0.5
Benzo(a)anthracene	RI/FS	123275	481177.02	1346409.88	360	UJ	ug/kg	0	0.5
Benzo(a)anthracene	RI/FS	123273	481295.48	1346363.17	370	UJ	ug/kg	0	0.5
Benzo(a)anthracene	RI/FS	123411	481060.07	1346522.41	380	UJ	ug/kg	0	0.5
Benzo(a)anthracene	Unknown	061077	481074.26	1346563.08	390	U	ug/kg	1.5	2
Benzo(a)anthracene	RI/FS	123276	481481	1346307	390	UJ	ug/kg	0	0.5
Benzo(a)anthracene	Unknown	061028	482073.77	1346590.37	400	U	ug/kg	1.5	2
Benzo(a)anthracene	Unknown	061042	481679.46	1346379.58	400	U	ug/kg	1.5	2
Benzo(a)anthracene	Unknown	061049	481479.56	1346374.08	400	U	ug/kg	1.5	2
Benzo(a)anthracene	Unknown	061035	481873.87	1346584.87	440	U	ug/kg	1.5	2
Benzo(a)anthracene	RI/FS	123278	481681	1346320	920	UJ	ug/kg	0	0.5
Benzo(a)pyrene	RI/FS	123287	481902	1346539	110	J	ug/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Benzo(a)pyrene	RI/FS	123275	481177.02	1346409.88	360 UJ		ug/kg	0	0.5
Benzo(a)pyrene	RI/FS	123273	481295.48	1346363.17	370 UJ		ug/kg	0	0.5
Benzo(a)pyrene	RI/FS	123411	481060.07	1346522.41	380 UJ		ug/kg	0	0.5
Benzo(a)pyrene	Unknown	061077	481074.26	1346563.08	390 U		ug/kg	1.5	2
Benzo(a)pyrene	RI/FS	123276	481481	1346307	390 UJ		ug/kg	0	0.5
Benzo(a)pyrene	Unknown	061028	482073.77	1346590.37	400 U		ug/kg	1.5	2
Benzo(a)pyrene	Unknown	061042	481679.46	1346379.58	400 U		ug/kg	1.5	2
Benzo(a)pyrene	Unknown	061049	481479.56	1346374.08	400 U		ug/kg	1.5	2
Benzo(a)pyrene	Unknown	061035	481873.87	1346584.87	440 U		ug/kg	1.5	2
Benzo(a)pyrene	RI/FS	123278	481681	1346320	920 UJ		ug/kg	0	0.5
Benzo(b)fluoranthene	RI/FS	123276	481481	1346307	39 J		ug/kg	0	0.5
Benzo(b)fluoranthene	RI/FS	123287	481902	1346539	190 J		ug/kg	0	0.5
Benzo(b)fluoranthene	RI/FS	123275	481177.02	1346409.88	360 UJ		ug/kg	0	0.5
Benzo(b)fluoranthene	RI/FS	123273	481295.48	1346363.17	370 UJ		ug/kg	0	0.5
Benzo(b)fluoranthene	RI/FS	123411	481060.07	1346522.41	380 UJ		ug/kg	0	0.5
Benzo(b)fluoranthene	Unknown	061077	481074.26	1346563.08	390 U		ug/kg	1.5	2
Benzo(b)fluoranthene	Unknown	061028	482073.77	1346590.37	400 U		ug/kg	1.5	2
Benzo(b)fluoranthene	Unknown	061042	481679.46	1346379.58	400 U		ug/kg	1.5	2
Benzo(b)fluoranthene	Unknown	061049	481479.56	1346374.08	400 U		ug/kg	1.5	2
Benzo(b)fluoranthene	Unknown	061035	481873.87	1346584.87	440 U		ug/kg	1.5	2
Benzo(b)fluoranthene	RI/FS	123278	481681	1346320	920 UJ		ug/kg	0	0.5
Benzo(k)fluoranthene	RI/FS	123275	481177.02	1346409.88	360 UJ		ug/kg	0	0.5
Benzo(k)fluoranthene	RI/FS	123273	481295.48	1346363.17	370 UJ		ug/kg	0	0.5
Benzo(k)fluoranthene	RI/FS	123411	481060.07	1346522.41	380 UJ		ug/kg	0	0.5
Benzo(k)fluoranthene	Unknown	061077	481074.26	1346563.08	390 U		ug/kg	1.5	2
Benzo(k)fluoranthene	RI/FS	123276	481481	1346307	390 UJ		ug/kg	0	0.5
Benzo(k)fluoranthene	Unknown	061028	482073.77	1346590.37	400 U		ug/kg	1.5	2
Benzo(k)fluoranthene	Unknown	061042	481679.46	1346379.58	400 U		ug/kg	1.5	2
Benzo(k)fluoranthene	Unknown	061049	481479.56	1346374.08	400 U		ug/kg	1.5	2
Benzo(k)fluoranthene	Unknown	061035	481873.87	1346584.87	440 U		ug/kg	1.5	2
Benzo(k)fluoranthene	RI/FS	123287	481902	1346539	540 UJ		ug/kg	0	0.5
Benzo(k)fluoranthene	RI/FS	123278	481681	1346320	920 UJ		ug/kg	0	0.5
Beryllium	RI/FS	123411	481060.07	1346522.41	0.42 U		mg/kg	0	0.5
Beryllium	RI/FS	123275	481177.02	1346409.88	0.43 U		mg/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Beryllium	RI/FS	123273	481295.48	1346363.17	0.45	U	mg/kg	0	0.5
Beryllium	RI/FS	123276	481481	1346307	0.45	U	mg/kg	0	0.5
Beryllium	Unknown	061037	481679.46	1346379.58	0.58	-	mg/kg	0	0.5
Beryllium	Unknown	061072	481074.26	1346563.08	0.62	-	mg/kg	0	0.5
Beryllium	RI/FS	123287	481902	1346539	0.65	U	mg/kg	0	0.5
Beryllium	Unknown	061030	481873.87	1346584.87	0.69	-	mg/kg	0	0.5
Beryllium	Unknown	061058	481176.96	1346465.78	0.72	-	mg/kg	0	0.5
Beryllium	Unknown	061023	482073.77	1346590.37	0.75	-	mg/kg	0	0.5
Beryllium	Unknown	061044	481479.56	1346374.08	0.76	-	mg/kg	0	0.5
Beryllium	RI/FS	123278	481681	1346320	0.99	UJ	mg/kg	0	0.5
bis(2-Chloroisopropyl) ether	RI/FS	123275	481177.02	1346409.88	360	UJ	ug/kg	0	0.5
bis(2-Chloroisopropyl) ether	RI/FS	123411	481060.07	1346522.41	380	UJ	ug/kg	0	0.5
bis(2-Chloroisopropyl) ether	RI/FS	123276	481481	1346307	390	UJ	ug/kg	0	0.5
bis(2-Chloroisopropyl) ether	Unknown	061077	481074.26	1346563.08	390	UJ	ug/kg	1.5	2
bis(2-Chloroisopropyl) ether	Unknown	061028	482073.77	1346590.37	400	U	ug/kg	1.5	2
bis(2-Chloroisopropyl) ether	Unknown	061049	481479.56	1346374.08	400	U	ug/kg	1.5	2
bis(2-Chloroisopropyl) ether	Unknown	061042	481679.46	1346379.58	400	UJ	ug/kg	1.5	2
bis(2-Chloroisopropyl) ether	Unknown	061035	481873.87	1346584.87	440	U	ug/kg	1.5	2
bis(2-Chloroisopropyl) ether	RI/FS	123287	481902	1346539	540	UJ	ug/kg	0	0.5
bis(2-Chloroisopropyl) ether	RI/FS	123278	481681	1346320	920	UJ	ug/kg	0	0.5
bis(2-Ethylhexyl)phthalate	Unknown	061035	481873.87	1346584.87	55	J	ug/kg	1.5	2
bis(2-Ethylhexyl)phthalate	Unknown	061042	481679.46	1346379.58	200	J	ug/kg	1.5	2
bis(2-Ethylhexyl)phthalate	RI/FS	123275	481177.02	1346409.88	370	J	ug/kg	0	0.5
bis(2-Ethylhexyl)phthalate	RI/FS	123411	481060.07	1346522.41	380	UJ	ug/kg	0	0.5
bis(2-Ethylhexyl)phthalate	RI/FS	123276	481481	1346307	390	U	ug/kg	0	0.5
bis(2-Ethylhexyl)phthalate	RI/FS	123273	481295.48	1346363.17	450	J	ug/kg	0	0.5
bis(2-Ethylhexyl)phthalate	RI/FS	123287	481902	1346539	540	U	ug/kg	0	0.5
bis(2-Ethylhexyl)phthalate	Unknown	061028	482073.77	1346590.37	600	-	ug/kg	1.5	2
bis(2-Ethylhexyl)phthalate	RI/FS	123278	481681	1346320	840	U	ug/kg	0	0.5
bis(2-Ethylhexyl)phthalate	Unknown	061077	481074.26	1346563.08	1100	-	ug/kg	1.5	2
bis(2-Ethylhexyl)phthalate	Unknown	061049	481479.56	1346374.08	1100	-	ug/kg	1.5	2
Bromodichloromethane	Unknown	061077	481074.26	1346563.08	6	U	ug/kg	1.5	2
Bromodichloromethane	Unknown	061028	482073.77	1346590.37	6	U	ug/kg	1.5	2
Bromodichloromethane	Unknown	061035	481873.87	1346584.87	6	U	ug/kg	1.5	2

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Bromodichloromethane	Unknown	061042	481679.46	1346379.58	6 U		ug/kg	1.5	2
Bromodichloromethane	Unknown	061049	481479.56	1346374.08	6 U		ug/kg	1.5	2
Bromodichloromethane	RI/FS	123411	481060.07	1346522.41	11 U		ug/kg	0	0.5
Bromodichloromethane	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
Bromodichloromethane	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
Bromodichloromethane	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
Bromodichloromethane	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
Bromodichloromethane	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
Bromoform	Unknown	061077	481074.26	1346563.08	6 U		ug/kg	1.5	2
Bromoform	Unknown	061028	482073.77	1346590.37	6 U		ug/kg	1.5	2
Bromoform	Unknown	061035	481873.87	1346584.87	6 U		ug/kg	1.5	2
Bromoform	Unknown	061042	481679.46	1346379.58	6 U		ug/kg	1.5	2
Bromoform	Unknown	061049	481479.56	1346374.08	6 U		ug/kg	1.5	2
Bromoform	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
Bromoform	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
Bromoform	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
Bromoform	RI/FS	123411	481060.07	1346522.41	11 UJ		ug/kg	0	0.5
Bromoform	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
Bromoform	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
Bromomethane	RI/FS	123411	481060.07	1346522.41	11 U		ug/kg	0	0.5
Bromomethane	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
Bromomethane	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
Bromomethane	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
Bromomethane	Unknown	061049	481479.56	1346374.08	12 U		ug/kg	1.5	2
Bromomethane	Unknown	061077	481074.26	1346563.08	12 UJ		ug/kg	1.5	2
Bromomethane	Unknown	061028	482073.77	1346590.37	12 UJ		ug/kg	1.5	2
Bromomethane	Unknown	061042	481679.46	1346379.58	12 UJ		ug/kg	1.5	2
Bromomethane	Unknown	061035	481873.87	1346584.87	13 UJ		ug/kg	1.5	2
Bromomethane	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
Bromomethane	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
Cadmium	RI/FS	123411	481060.07	1346522.41	1 U		mg/kg	0	0.5
Cadmium	RI/FS	123275	481177.02	1346409.88	1.1 U		mg/kg	0	0.5
Cadmium	RI/FS	123273	481295.48	1346363.17	1.1 U		mg/kg	0	0.5
Cadmium	RI/FS	123276	481481	1346307	1.1 U		mg/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Cadmium	RI/FS	123287	481902	1346539	1.6	U	mg/kg	0	0.5
Cadmium	RI/FS	123278	481681	1346320	2.5	UJ	mg/kg	0	0.5
Cadmium	Unknown	061030	481873.87	1346584.87	3.4	J	mg/kg	0	0.5
Cadmium	Unknown	061072	481074.26	1346563.08	4	J	mg/kg	0	0.5
Cadmium	Unknown	061037	481679.46	1346379.58	4.6	J	mg/kg	0	0.5
Cadmium	Unknown	061023	482073.77	1346590.37	5.7	J	mg/kg	0	0.5
Cadmium	Unknown	061058	481176.96	1346465.78	5.7	J	mg/kg	0	0.5
Cadmium	Unknown	061044	481479.56	1346374.08	5.9	-	mg/kg	0	0.5
Carbazole	RI/FS	123273	481295.48	1346363.17	40	J	ug/kg	0	0.5
Carbazole	RI/FS	123287	481902	1346539	76	J	ug/kg	0	0.5
Carbazole	RI/FS	123275	481177.02	1346409.88	360	UJ	ug/kg	0	0.5
Carbon disulfide	Unknown	061077	481074.26	1346563.08	6	U	ug/kg	1.5	2
Carbon disulfide	Unknown	061028	482073.77	1346590.37	6	U	ug/kg	1.5	2
Carbon disulfide	Unknown	061035	481873.87	1346584.87	6	U	ug/kg	1.5	2
Carbon disulfide	Unknown	061042	481679.46	1346379.58	6	U	ug/kg	1.5	2
Carbon disulfide	Unknown	061049	481479.56	1346374.08	6	U	ug/kg	1.5	2
Carbon disulfide	RI/FS	123411	481060.07	1346522.41	11	UJ	ug/kg	0	0.5
Carbon Tetrachloride	Unknown	061077	481074.26	1346563.08	6	U	ug/kg	1.5	2
Carbon Tetrachloride	Unknown	061028	482073.77	1346590.37	6	U	ug/kg	1.5	2
Carbon Tetrachloride	Unknown	061035	481873.87	1346584.87	6	U	ug/kg	1.5	2
Carbon Tetrachloride	Unknown	061042	481679.46	1346379.58	6	U	ug/kg	1.5	2
Carbon Tetrachloride	Unknown	061049	481479.56	1346374.08	6	U	ug/kg	1.5	2
Carbon Tetrachloride	RI/FS	123411	481060.07	1346522.41	11	U	ug/kg	0	0.5
Carbon Tetrachloride	RI/FS	123275	481177.02	1346409.88	11	U	ug/kg	0	0.5
Carbon Tetrachloride	RI/FS	123273	481295.48	1346363.17	11	U	ug/kg	0	0.5
Carbon Tetrachloride	RI/FS	123276	481481	1346307	11	U	ug/kg	0	0.5
Carbon Tetrachloride	RI/FS	123287	481902	1346539	16	U	ug/kg	0	0.5
Carbon Tetrachloride	RI/FS	123278	481681	1346320	28	U	ug/kg	0	0.5
Cesium-137	RI/FS	123273	481295.48	1346363.17	0.018	UJ	pCi/g	0	0.5
Cesium-137	RI/FS	123275	481177.02	1346409.88	0.0434	J	pCi/g	0	0.5
Cesium-137	RI/FS	123276	481481	1346307	0.0862	J	pCi/g	0	0.5
Cesium-137	RI/FS	123287	481902	1346539	0.091	J	pCi/g	0	0.5
Cesium-137	CIS	SD-31-005	481260.3827	1346385.051	0.1	UNV	pCi/g	0	0.5
Cesium-137	RI/FS	123411	481060.07	1346522.41	0.12	UJ	pCi/g	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Cesium-137	RI/FS	123278	481681	1346320	0.121 J		pCi/g	0	0.5
Cesium-137	Unknown	005435	482029.3832	1346431.042	0.2 J		pCi/g	0	0.16667
Cesium-137	Unknown	005496	481029.3843	1346531.053	0.2 U		pCi/g	0	0.16667
Cesium-137	Unknown	075500	481152.4441	1346513.712	0.2 UJ		pCi/g	0	0.5
Cesium-137	Unknown	005493	481629.38	1346131.047	0.2 UJ		pCi/g	0	0.16667
Cesium-137	Unknown	005125	482029.3843	1346531.042	0.2 UJ		pCi/g	0	0.16667
Cesium-137	Unknown	005126	482029.3843	1346531.042	0.2 UJ		pCi/g	0	0.16667
Cesium-137	CIS	SD-31-004	481170.3832	1346433.052	0.2 UNV		pCi/g	0	0.25
Cesium-137	CIS	SD-31-006	481353.3823	1346348.05	0.3 UNV		pCi/g	0	0.5
Cesium-137	CIS	SD-31-003	481117.3841	1346513.052	0.7 UNV		pCi/g	0	0.5
Cesium-137	CIS	SD-26-018	482082.3812	1346241.042	0.7 UNV		pCi/g	0	0.25
Chlorobenzene	Unknown	061077	481074.26	1346563.08	6 U		ug/kg	1.5	2
Chlorobenzene	Unknown	061028	482073.77	1346590.37	6 U		ug/kg	1.5	2
Chlorobenzene	Unknown	061035	481873.87	1346584.87	6 U		ug/kg	1.5	2
Chlorobenzene	Unknown	061042	481679.46	1346379.58	6 U		ug/kg	1.5	2
Chlorobenzene	Unknown	061049	481479.56	1346374.08	6 U		ug/kg	1.5	2
Chlorobenzene	RI/FS	123411	481060.07	1346522.41	11 U		ug/kg	0	0.5
Chlorobenzene	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
Chlorobenzene	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
Chlorobenzene	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
Chlorobenzene	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
Chlorobenzene	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
Chloroethane	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
Chloroethane	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
Chloroethane	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
Chloroethane	RI/FS	123411	481060.07	1346522.41	11 UJ		ug/kg	0	0.5
Chloroethane	Unknown	061077	481074.26	1346563.08	12 U		ug/kg	1.5	2
Chloroethane	Unknown	061028	482073.77	1346590.37	12 U		ug/kg	1.5	2
Chloroethane	Unknown	061042	481679.46	1346379.58	12 U		ug/kg	1.5	2
Chloroethane	Unknown	061049	481479.56	1346374.08	12 U		ug/kg	1.5	2
Chloroethane	Unknown	061035	481873.87	1346584.87	13 U		ug/kg	1.5	2
Chloroethane	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
Chloroethane	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
Chloroform	Unknown	061077	481074.26	1346563.08	6 U		ug/kg	1.5	2

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Chloroform	Unknown	061028	482073.77	1346590.37	6 U		ug/kg	1.5	2
Chloroform	Unknown	061035	481873.87	1346584.87	6 U		ug/kg	1.5	2
Chloroform	Unknown	061042	481679.46	1346379.58	6 U		ug/kg	1.5	2
Chloroform	Unknown	061049	481479.56	1346374.08	6 U		ug/kg	1.5	2
Chloroform	RI/FS	123411	481060.07	1346522.41	11 U		ug/kg	0	0.5
Chloroform	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
Chloroform	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
Chloroform	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
Chloroform	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
Chloroform	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
Chromium	Unknown	061037	481679.46	1346379.58	6.1 -		mg/kg	0	0.5
Chromium	Unknown	061044	481479.56	1346374.08	7.4 -		mg/kg	0	0.5
Chromium	RI/FS	123278	481681	1346320	8.3 J		mg/kg	0	0.5
Chromium	RI/FS	123275	481177.02	1346409.88	9.1 -		mg/kg	0	0.5
Chromium	RI/FS	123273	481295.48	1346363.17	9.5 -		mg/kg	0	0.5
Chromium	RI/FS	123411	481060.07	1346522.41	9.8 -		mg/kg	0	0.5
Chromium	RI/FS	123276	481481	1346307	13 -		mg/kg	0	0.5
Chromium	Unknown	061072	481074.26	1346563.08	13.3 -		mg/kg	0	0.5
Chromium	Unknown	061058	481176.96	1346465.78	14.4 -		mg/kg	0	0.5
Chromium	Unknown	061023	482073.77	1346590.37	16.3 -		mg/kg	0	0.5
Chromium	RI/FS	123287	481902	1346539	16.5 -		mg/kg	0	0.5
Chromium	Unknown	061030	481873.87	1346584.87	17 -		mg/kg	0	0.5
Chrysene	RI/FS	123287	481902	1346539	100 J		ug/kg	0	0.5
Chrysene	RI/FS	123275	481177.02	1346409.88	360 UJ		ug/kg	0	0.5
Chrysene	RI/FS	123273	481295.48	1346363.17	370 UJ		ug/kg	0	0.5
Chrysene	RI/FS	123411	481060.07	1346522.41	380 UJ		ug/kg	0	0.5
Chrysene	Unknown	061077	481074.26	1346563.08	390 U		ug/kg	1.5	2
Chrysene	RI/FS	123276	481481	1346307	390 UJ		ug/kg	0	0.5
Chrysene	Unknown	061028	482073.77	1346590.37	400 U		ug/kg	1.5	2
Chrysene	Unknown	061042	481679.46	1346379.58	400 U		ug/kg	1.5	2
Chrysene	Unknown	061049	481479.56	1346374.08	400 U		ug/kg	1.5	2
Chrysene	Unknown	061035	481873.87	1346584.87	440 U		ug/kg	1.5	2
Chrysene	RI/FS	123278	481681	1346320	920 UJ		ug/kg	0	0.5
Cobalt	RI/FS	123275	481177.02	1346409.88	3.9 -		mg/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Cobalt	RI/FS	123273	481295.48	1346363.17	4.6	-	mg/kg	0	0.5
Cobalt	RI/FS	123411	481060.07	1346522.41	4.9	-	mg/kg	0	0.5
Cobalt	RI/FS	123278	481681	1346320	4.9	UJ	mg/kg	0	0.5
Cobalt	RI/FS	123276	481481	1346307	5.1	-	mg/kg	0	0.5
Cobalt	Unknown	061037	481679.46	1346379.58	7	-	mg/kg	0	0.5
Cobalt	RI/FS	123287	481902	1346539	8.5	-	mg/kg	0	0.5
Cobalt	Unknown	061072	481074.26	1346563.08	8.5	-	mg/kg	0	0.5
Cobalt	Unknown	061044	481479.56	1346374.08	9	-	mg/kg	0	0.5
Cobalt	Unknown	061058	481176.96	1346465.78	10.6	-	mg/kg	0	0.5
Cobalt	Unknown	061023	482073.77	1346590.37	10.9	-	mg/kg	0	0.5
Cobalt	Unknown	061030	481873.87	1346584.87	11.1	-	mg/kg	0	0.5
Copper	RI/FS	123275	481177.02	1346409.88	9.1	-	mg/kg	0	0.5
Copper	Unknown	061037	481679.46	1346379.58	11.4	-	mg/kg	0	0.5
Copper	RI/FS	123411	481060.07	1346522.41	12.2	-	mg/kg	0	0.5
Copper	RI/FS	123273	481295.48	1346363.17	12.3	-	mg/kg	0	0.5
Copper	Unknown	061072	481074.26	1346563.08	13.8	-	mg/kg	0	0.5
Copper	RI/FS	123278	481681	1346320	13.8	J	mg/kg	0	0.5
Copper	RI/FS	123276	481481	1346307	14.6	-	mg/kg	0	0.5
Copper	Unknown	061030	481873.87	1346584.87	14.6	-	mg/kg	0	0.5
Copper	Unknown	061058	481176.96	1346465.78	14.8	-	mg/kg	0	0.5
Copper	Unknown	061023	482073.77	1346590.37	18.3	-	mg/kg	0	0.5
Copper	Unknown	061044	481479.56	1346374.08	18.5	-	mg/kg	0	0.5
Copper	RI/FS	123287	481902	1346539	22	-	mg/kg	0	0.5
Cyanide	RI/FS	123273	481295.48	1346363.17	0.11	U	mg/kg	0	0.5
Cyanide	RI/FS	123276	481481	1346307	0.11	U	mg/kg	0	0.5
Cyanide	Unknown	061072	481074.26	1346563.08	0.11	U	mg/kg	0	0.5
Cyanide	Unknown	061037	481679.46	1346379.58	0.11	U	mg/kg	0	0.5
Cyanide	Unknown	061044	481479.56	1346374.08	0.11	U	mg/kg	0	0.5
Cyanide	RI/FS	123411	481060.07	1346522.41	0.11	UJ	mg/kg	0	0.5
Cyanide	Unknown	061023	482073.77	1346590.37	0.12	U	mg/kg	0	0.5
Cyanide	Unknown	061058	481176.96	1346465.78	0.12	U	mg/kg	0	0.5
Cyanide	Unknown	061030	481873.87	1346584.87	0.13	U	mg/kg	0	0.5
Cyanide	RI/FS	123275	481177.02	1346409.88	0.2	-	mg/kg	0	0.5
Cyanide	RI/FS	123278	481681	1346320	0.33	J	mg/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Cyanide	RI/FS	123287	481902	1346539	0.47	-	mg/kg	0	0.5
Dibenzo(a,h)anthracene	RI/FS	123275	481177.02	1346409.88	360	UJ	ug/kg	0	0.5
Dibenzo(a,h)anthracene	RI/FS	123273	481295.48	1346363.17	370	UJ	ug/kg	0	0.5
Dibenzo(a,h)anthracene	RI/FS	123411	481060.07	1346522.41	380	UJ	ug/kg	0	0.5
Dibenzo(a,h)anthracene	Unknown	061077	481074.26	1346563.08	390	U	ug/kg	1.5	2
Dibenzo(a,h)anthracene	RI/FS	123276	481481	1346307	390	UJ	ug/kg	0	0.5
Dibenzo(a,h)anthracene	Unknown	061028	482073.77	1346590.37	400	U	ug/kg	1.5	2
Dibenzo(a,h)anthracene	Unknown	061042	481679.46	1346379.58	400	U	ug/kg	1.5	2
Dibenzo(a,h)anthracene	Unknown	061049	481479.56	1346374.08	400	U	ug/kg	1.5	2
Dibenzo(a,h)anthracene	Unknown	061035	481873.87	1346584.87	440	U	ug/kg	1.5	2
Dibenzo(a,h)anthracene	RI/FS	123287	481902	1346539	540	UJ	ug/kg	0	0.5
Dibenzo(a,h)anthracene	RI/FS	123278	481681	1346320	920	UJ	ug/kg	0	0.5
Dieldrin	Unknown	061037	481679.46	1346379.58	18	U	ug/kg	0	0.5
Dieldrin	Unknown	061072	481074.26	1346563.08	19	U	ug/kg	0	0.5
Dieldrin	Unknown	061044	481479.56	1346374.08	19	U	ug/kg	0	0.5
Dieldrin	Unknown	061030	481873.87	1346584.87	20	-	ug/kg	0	0.5
Dieldrin	Unknown	061023	482073.77	1346590.37	20	U	ug/kg	0	0.5
Dieldrin	Unknown	061058	481176.96	1346465.78	20	U	ug/kg	0	0.5
Di-n-octyl phthalate	RI/FS	123275	481177.02	1346409.88	360	UJ	ug/kg	0	0.5
Di-n-octyl phthalate	RI/FS	123273	481295.48	1346363.17	370	UJ	ug/kg	0	0.5
Di-n-octyl phthalate	RI/FS	123411	481060.07	1346522.41	380	UJ	ug/kg	0	0.5
Di-n-octyl phthalate	Unknown	061077	481074.26	1346563.08	390	U	ug/kg	1.5	2
Di-n-octyl phthalate	RI/FS	123276	481481	1346307	390	UJ	ug/kg	0	0.5
Di-n-octyl phthalate	Unknown	061028	482073.77	1346590.37	400	U	ug/kg	1.5	2
Di-n-octyl phthalate	Unknown	061042	481679.46	1346379.58	400	U	ug/kg	1.5	2
Di-n-octyl phthalate	Unknown	061049	481479.56	1346374.08	400	U	ug/kg	1.5	2
Di-n-octyl phthalate	Unknown	061035	481873.87	1346584.87	440	U	ug/kg	1.5	2
Di-n-octyl phthalate	RI/FS	123287	481902	1346539	540	UJ	ug/kg	0	0.5
Di-n-octyl phthalate	RI/FS	123278	481681	1346320	920	UJ	ug/kg	0	0.5
Ethylbenzene	Unknown	061077	481074.26	1346563.08	6	U	ug/kg	1.5	2
Ethylbenzene	Unknown	061028	482073.77	1346590.37	6	U	ug/kg	1.5	2
Ethylbenzene	Unknown	061035	481873.87	1346584.87	6	U	ug/kg	1.5	2
Ethylbenzene	Unknown	061042	481679.46	1346379.58	6	U	ug/kg	1.5	2
Ethylbenzene	Unknown	061049	481479.56	1346374.08	6	U	ug/kg	1.5	2

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Ethylbenzene	RI/FS	123411	481060.07	1346522.41	11 U		ug/kg	0	0.5
Ethylbenzene	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
Ethylbenzene	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
Ethylbenzene	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
Ethylbenzene	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
Ethylbenzene	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
Heptachlorodibenzofurans	RI/FS	123275	481177.02	1346409.88	490 U		ng/kg	0	0.5
Heptachlorodibenzofurans	RI/FS	123273	481295.48	1346363.17	610 U		ng/kg	0	0.5
Heptachlorodibenzofurans	RI/FS	123411	481060.07	1346522.41	730 U		ng/kg	0	0.5
Heptachlorodibenzofurans	RI/FS	123276	481481	1346307	990 U		ng/kg	0	0.5
Heptachlorodibenzofurans	RI/FS	123287	481902	1346539	1000 U		ng/kg	0	0.5
Heptachlorodibenzofurans	RI/FS	123278	481681	1346320	1200 U		ng/kg	0	0.5
Heptachlorodibenzo-p-dioxins	RI/FS	123275	481177.02	1346409.88	190 U		ng/kg	0	0.5
Heptachlorodibenzo-p-dioxins	RI/FS	123411	481060.07	1346522.41	220 U		ng/kg	0	0.5
Heptachlorodibenzo-p-dioxins	RI/FS	123273	481295.48	1346363.17	300 U		ng/kg	0	0.5
Heptachlorodibenzo-p-dioxins	RI/FS	123276	481481	1346307	380 U		ng/kg	0	0.5
Heptachlorodibenzo-p-dioxins	RI/FS	123278	481681	1346320	430 U		ng/kg	0	0.5
Heptachlorodibenzo-p-dioxins	RI/FS	123287	481902	1346539	580 U		ng/kg	0	0.5
Indeno(1,2,3-cd)pyrene	RI/FS	123287	481902	1346539	65 J		ug/kg	0	0.5
Indeno(1,2,3-cd)pyrene	RI/FS	123275	481177.02	1346409.88	360 UJ		ug/kg	0	0.5
Indeno(1,2,3-cd)pyrene	RI/FS	123273	481295.48	1346363.17	370 UJ		ug/kg	0	0.5
Indeno(1,2,3-cd)pyrene	RI/FS	123411	481060.07	1346522.41	380 UJ		ug/kg	0	0.5
Indeno(1,2,3-cd)pyrene	Unknown	061077	481074.26	1346563.08	390 U		ug/kg	1.5	2
Indeno(1,2,3-cd)pyrene	RI/FS	123276	481481	1346307	390 UJ		ug/kg	0	0.5
Indeno(1,2,3-cd)pyrene	Unknown	061028	482073.77	1346590.37	400 U		ug/kg	1.5	2
Indeno(1,2,3-cd)pyrene	Unknown	061042	481679.46	1346379.58	400 U		ug/kg	1.5	2
Indeno(1,2,3-cd)pyrene	Unknown	061049	481479.56	1346374.08	400 U		ug/kg	1.5	2
Indeno(1,2,3-cd)pyrene	Unknown	061035	481873.87	1346584.87	440 U		ug/kg	1.5	2
Indeno(1,2,3-cd)pyrene	RI/FS	123278	481681	1346320	920 UJ		ug/kg	0	0.5
Lead	RI/FS	123273	481295.48	1346363.17	5.4 -		mg/kg	0	0.5
Lead	Unknown	061072	481074.26	1346563.08	7.8 J		mg/kg	0	0.5
Lead	RI/FS	123275	481177.02	1346409.88	7.9 -		mg/kg	0	0.5
Lead	Unknown	061058	481176.96	1346465.78	7.9 J		mg/kg	0	0.5
Lead	Unknown	061037	481679.46	1346379.58	8.4 J		mg/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Lead	RI/FS	123278	481681	1346320	8.6 J		mg/kg	0	0.5
Lead	Unknown	061023	482073.77	1346590.37	10.5 J		mg/kg	0	0.5
Lead	RI/FS	123411	481060.07	1346522.41	10.8 -		mg/kg	0	0.5
Lead	RI/FS	123276	481481	1346307	11.7 -		mg/kg	0	0.5
Lead	Unknown	061030	481873.87	1346584.87	12.1 J		mg/kg	0	0.5
Lead	Unknown	061044	481479.56	1346374.08	13.5 J		mg/kg	0	0.5
Lead	RI/FS	123287	481902	1346539	18.8 -		mg/kg	0	0.5
Manganese	RI/FS	123278	481681	1346320	142 J		mg/kg	0	0.5
Manganese	Unknown	061037	481679.46	1346379.58	426 -		mg/kg	0	0.5
Manganese	Unknown	061023	482073.77	1346590.37	438 -		mg/kg	0	0.5
Manganese	RI/FS	123411	481060.07	1346522.41	450 -		mg/kg	0	0.5
Manganese	RI/FS	123275	481177.02	1346409.88	467 -		mg/kg	0	0.5
Manganese	RI/FS	123273	481295.48	1346363.17	470 -		mg/kg	0	0.5
Manganese	RI/FS	123276	481481	1346307	476 -		mg/kg	0	0.5
Manganese	Unknown	061058	481176.96	1346465.78	556 -		mg/kg	0	0.5
Manganese	Unknown	061044	481479.56	1346374.08	638 -		mg/kg	0	0.5
Manganese	Unknown	061030	481873.87	1346584.87	655 -		mg/kg	0	0.5
Manganese	Unknown	061072	481074.26	1346563.08	707 -		mg/kg	0	0.5
Manganese	RI/FS	123287	481902	1346539	1020 -		mg/kg	0	0.5
Mercury	RI/FS	123411	481060.07	1346522.41	0.1 U		mg/kg	0	0.5
Mercury	RI/FS	123275	481177.02	1346409.88	0.1 U		mg/kg	0	0.5
Mercury	RI/FS	123273	481295.48	1346363.17	0.11 U		mg/kg	0	0.5
Mercury	RI/FS	123276	481481	1346307	0.11 U		mg/kg	0	0.5
Mercury	Unknown	061037	481679.46	1346379.58	0.11 U		mg/kg	0	0.5
Mercury	Unknown	061044	481479.56	1346374.08	0.11 U		mg/kg	0	0.5
Mercury	Unknown	061072	481074.26	1346563.08	0.12 U		mg/kg	0	0.5
Mercury	Unknown	061023	482073.77	1346590.37	0.12 U		mg/kg	0	0.5
Mercury	Unknown	061030	481873.87	1346584.87	0.12 U		mg/kg	0	0.5
Mercury	Unknown	061058	481176.96	1346465.78	0.12 U		mg/kg	0	0.5
Mercury	RI/FS	123287	481902	1346539	0.16 U		mg/kg	0	0.5
Mercury	RI/FS	123278	481681	1346320	0.27 UJ		mg/kg	0	0.5
Methylene chloride	Unknown	061035	481873.87	1346584.87	6 UJ		ug/kg	1.5	2
Methylene chloride	Unknown	061028	482073.77	1346590.37	11 UJ		ug/kg	1.5	2
Methylene chloride	Unknown	061042	481679.46	1346379.58	12 UJ		ug/kg	1.5	2

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Methylene chloride	Unknown	061077	481074.26	1346563.08	14 UJ		ug/kg	1.5	2
Methylene chloride	Unknown	061049	481479.56	1346374.08	24 U		ug/kg	1.5	2
Methylene chloride	RI/FS	123275	481177.02	1346409.88	38 U		ug/kg	0	0.5
Methylene chloride	RI/FS	123276	481481	1346307	38 U		ug/kg	0	0.5
Methylene chloride	RI/FS	123273	481295.48	1346363.17	39 U		ug/kg	0	0.5
Methylene chloride	RI/FS	123411	481060.07	1346522.41	58 UJ		ug/kg	0	0.5
Methylene chloride	RI/FS	123287	481902	1346539	67 U		ug/kg	0	0.5
Methylene chloride	RI/FS	123278	481681	1346320	140 U		ug/kg	0	0.5
Molybdenum	Unknown	061030	481873.87	1346584.87	3 -		mg/kg	0	0.5
Molybdenum	Unknown	061072	481074.26	1346563.08	3.3 -		mg/kg	0	0.5
Molybdenum	Unknown	061037	481679.46	1346379.58	3.9 -		mg/kg	0	0.5
Molybdenum	Unknown	061044	481479.56	1346374.08	4.1 -		mg/kg	0	0.5
Molybdenum	RI/FS	123411	481060.07	1346522.41	4.2 U		mg/kg	0	0.5
Molybdenum	RI/FS	123275	481177.02	1346409.88	4.3 U		mg/kg	0	0.5
Molybdenum	Unknown	061058	481176.96	1346465.78	4.4 -		mg/kg	0	0.5
Molybdenum	RI/FS	123273	481295.48	1346363.17	4.5 U		mg/kg	0	0.5
Molybdenum	Unknown	061023	482073.77	1346590.37	4.6 -		mg/kg	0	0.5
Molybdenum	RI/FS	123276	481481	1346307	5.2 -		mg/kg	0	0.5
Molybdenum	RI/FS	123287	481902	1346539	6.5 U		mg/kg	0	0.5
Molybdenum	RI/FS	123278	481681	1346320	9.9 UJ		mg/kg	0	0.5
Neptunium-237	RI/FS	123287	481902	1346539	0.371 J		pCi/g	0	0.5
Neptunium-237	RI/FS	123278	481681	1346320	0.408 J		pCi/g	0	0.5
Neptunium-237	RI/FS	123273	481295.48	1346363.17	0.526 J		pCi/g	0	0.5
Neptunium-237	Unknown	005496	481029.3843	1346531.053	0.6 U		pCi/g	0	0.16667
Neptunium-237	Unknown	005493	481629.38	1346131.047	0.6 U		pCi/g	0	0.16667
Neptunium-237	Unknown	005435	482029.3832	1346431.042	0.6 U		pCi/g	0	0.16667
Neptunium-237	Unknown	005125	482029.3843	1346531.042	0.6 UJ		pCi/g	0	0.16667
Neptunium-237	Unknown	005126	482029.3843	1346531.042	0.6 UJ		pCi/g	0	0.16667
Neptunium-237	RI/FS	123411	481060.07	1346522.41	0.629 J		pCi/g	0	0.5
Neptunium-237	RI/FS	123275	481177.02	1346409.88	0.636 J		pCi/g	0	0.5
Neptunium-237	RI/FS	123276	481481	1346307	1.1 J		pCi/g	0	0.5
Nickel	RI/FS	123275	481177.02	1346409.88	7.6 -		mg/kg	0	0.5
Nickel	RI/FS	123278	481681	1346320	11.5 J		mg/kg	0	0.5
Nickel	RI/FS	123411	481060.07	1346522.41	11.9 -		mg/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Nickel	RI/FS	123273	481295.48	1346363.17	14.3	-	mg/kg	0	0.5
Nickel	RI/FS	123276	481481	1346307	14.5	-	mg/kg	0	0.5
Nickel	Unknown	061037	481679.46	1346379.58	19.7	-	mg/kg	0	0.5
Nickel	Unknown	061072	481074.26	1346563.08	20.8	-	mg/kg	0	0.5
Nickel	RI/FS	123287	481902	1346539	23.5	-	mg/kg	0	0.5
Nickel	Unknown	061044	481479.56	1346374.08	26.8	-	mg/kg	0	0.5
Nickel	Unknown	061023	482073.77	1346590.37	27.8	-	mg/kg	0	0.5
Nickel	Unknown	061030	481873.87	1346584.87	27.9	-	mg/kg	0	0.5
Nickel	Unknown	061058	481176.96	1346465.78	31.9	-	mg/kg	0	0.5
N-Nitrosodiphenylamine	RI/FS	123275	481177.02	1346409.88	360	UJ	ug/kg	0	0.5
N-Nitrosodiphenylamine	RI/FS	123273	481295.48	1346363.17	370	UJ	ug/kg	0	0.5
N-Nitrosodiphenylamine	RI/FS	123411	481060.07	1346522.41	380	UJ	ug/kg	0	0.5
N-Nitrosodiphenylamine	Unknown	061077	481074.26	1346563.08	390	U	ug/kg	1.5	2
N-Nitrosodiphenylamine	RI/FS	123276	481481	1346307	390	UJ	ug/kg	0	0.5
N-Nitrosodiphenylamine	Unknown	061028	482073.77	1346590.37	400	U	ug/kg	1.5	2
N-Nitrosodiphenylamine	Unknown	061042	481679.46	1346379.58	400	U	ug/kg	1.5	2
N-Nitrosodiphenylamine	Unknown	061049	481479.56	1346374.08	400	U	ug/kg	1.5	2
N-Nitrosodiphenylamine	Unknown	061035	481873.87	1346584.87	440	U	ug/kg	1.5	2
N-Nitrosodiphenylamine	RI/FS	123287	481902	1346539	540	UJ	ug/kg	0	0.5
N-Nitrosodiphenylamine	RI/FS	123278	481681	1346320	920	UJ	ug/kg	0	0.5
Octachlorodibenzofuran	RI/FS	123278	481681	1346320	210	U	ng/kg	0	0.5
Octachlorodibenzofuran	RI/FS	123276	481481	1346307	230	U	ng/kg	0	0.5
Octachlorodibenzofuran	RI/FS	123273	481295.48	1346363.17	250	U	ng/kg	0	0.5
Octachlorodibenzofuran	RI/FS	123275	481177.02	1346409.88	290	U	ng/kg	0	0.5
Octachlorodibenzofuran	RI/FS	123411	481060.07	1346522.41	300	U	ng/kg	0	0.5
Octachlorodibenzofuran	RI/FS	123287	481902	1346539	300	U	ng/kg	0	0.5
Octachlorodibenzo-p-dioxin	RI/FS	123276	481481	1346307	240	J	ng/kg	0	0.5
Octachlorodibenzo-p-dioxin	RI/FS	123278	481681	1346320	260	U	ng/kg	0	0.5
Octachlorodibenzo-p-dioxin	RI/FS	123273	481295.48	1346363.17	350	U	ng/kg	0	0.5
Octachlorodibenzo-p-dioxin	RI/FS	123275	481177.02	1346409.88	400	U	ng/kg	0	0.5
Octachlorodibenzo-p-dioxin	RI/FS	123411	481060.07	1346522.41	510	U	ng/kg	0	0.5
Octachlorodibenzo-p-dioxin	RI/FS	123287	481902	1346539	660	U	ng/kg	0	0.5
Pentachlorophenol	RI/FS	123275	481177.02	1346409.88	880	UJ	ug/kg	0	0.5
Pentachlorophenol	RI/FS	123273	481295.48	1346363.17	900	UJ	ug/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Pentachlorophenol	RI/FS	123411	481060.07	1346522.41	910	UJ	ug/kg	0	0.5
Pentachlorophenol	RI/FS	123276	481481	1346307	930	UJ	ug/kg	0	0.5
Pentachlorophenol	RI/FS	123287	481902	1346539	1300	UJ	ug/kg	0	0.5
Pentachlorophenol	Unknown	061077	481074.26	1346563.08	1900	U	ug/kg	1.5	2
Pentachlorophenol	Unknown	061028	482073.77	1346590.37	1900	U	ug/kg	1.5	2
Pentachlorophenol	Unknown	061049	481479.56	1346374.08	1900	U	ug/kg	1.5	2
Pentachlorophenol	Unknown	061042	481679.46	1346379.58	2000	U	ug/kg	1.5	2
Pentachlorophenol	Unknown	061035	481873.87	1346584.87	2100	U	ug/kg	1.5	2
Pentachlorophenol	RI/FS	123278	481681	1346320	2200	UJ	ug/kg	0	0.5
Phenanthrene	RI/FS	123287	481902	1346539	310	J	ug/kg	0	0.5
Phenanthrene	RI/FS	123275	481177.02	1346409.88	360	UJ	ug/kg	0	0.5
Phenanthrene	RI/FS	123273	481295.48	1346363.17	370	UJ	ug/kg	0	0.5
Phenanthrene	RI/FS	123411	481060.07	1346522.41	380	UJ	ug/kg	0	0.5
Phenanthrene	Unknown	061077	481074.26	1346563.08	390	U	ug/kg	1.5	2
Phenanthrene	RI/FS	123276	481481	1346307	390	UJ	ug/kg	0	0.5
Phenanthrene	Unknown	061028	482073.77	1346590.37	400	U	ug/kg	1.5	2
Phenanthrene	Unknown	061042	481679.46	1346379.58	400	U	ug/kg	1.5	2
Phenanthrene	Unknown	061049	481479.56	1346374.08	400	U	ug/kg	1.5	2
Phenanthrene	Unknown	061035	481873.87	1346584.87	440	U	ug/kg	1.5	2
Phenanthrene	RI/FS	123278	481681	1346320	920	UJ	ug/kg	0	0.5
Plutonium-238	RI/FS	123411	481060.07	1346522.41	0.0935	J	pCi/g	0	0.5
Plutonium-238	RI/FS	123273	481295.48	1346363.17	0.166	J	pCi/g	0	0.5
Plutonium-238	RI/FS	123276	481481	1346307	0.179	J	pCi/g	0	0.5
Plutonium-238	RI/FS	123275	481177.02	1346409.88	0.2	J	pCi/g	0	0.5
Plutonium-238	RI/FS	123287	481902	1346539	0.24	J	pCi/g	0	0.5
Plutonium-238	RI/FS	123278	481681	1346320	0.285	J	pCi/g	0	0.5
Plutonium-238	Unknown	075500	481152.4441	1346513.712	0.6	U	pCi/g	0	0.5
Plutonium-238	Unknown	005496	481029.3843	1346531.053	0.6	U	pCi/g	0	0.16667
Plutonium-238	Unknown	005435	482029.3832	1346431.042	0.6	U	pCi/g	0	0.16667
Plutonium-238	Unknown	005493	481629.38	1346131.047	0.6	UJ	pCi/g	0	0.16667
Plutonium-238	Unknown	005125	482029.3843	1346531.042	0.6	UJ	pCi/g	0	0.16667
Plutonium-238	Unknown	005126	482029.3843	1346531.042	0.6	UJ	pCi/g	0	0.16667
Plutonium-239/240	RI/FS	123411	481060.07	1346522.41	0.0911	J	pCi/g	0	0.5
Plutonium-239/240	RI/FS	123276	481481	1346307	0.116	J	pCi/g	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Plutonium-239/240	RI/FS	123273	481295.48	1346363.17	0.118 J		pCi/g	0	0.5
Plutonium-239/240	RI/FS	123287	481902	1346539	0.165 J		pCi/g	0	0.5
Plutonium-239/240	RI/FS	123278	481681	1346320	0.168 J		pCi/g	0	0.5
Plutonium-239/240	RI/FS	123275	481177.02	1346409.88	0.186 J		pCi/g	0	0.5
Plutonium-239/240	Unknown	075500	481152.4441	1346513.712	0.6 U		pCi/g	0	0.5
Plutonium-239/240	Unknown	005496	481029.3843	1346531.053	0.6 U		pCi/g	0	0.16667
Plutonium-239/240	Unknown	005435	482029.3832	1346431.042	0.6 U		pCi/g	0	0.16667
Plutonium-239/240	Unknown	005125	482029.3843	1346531.042	0.6 U		pCi/g	0	0.16667
Plutonium-239/240	Unknown	005126	482029.3843	1346531.042	0.6 U		pCi/g	0	0.16667
Plutonium-239/240	Unknown	005493	481629.38	1346131.047	0.6 UJ		pCi/g	0	0.16667
Radium-226	CIS	SD-31-006	481353.3823	1346348.05	0.4 NV		pCi/g	0	0.5
Radium-226	Unknown	005125	482029.3843	1346531.042	0.4 UJ		pCi/g	0	0.16667
Radium-226	Unknown	005126	482029.3843	1346531.042	0.5 UJ		pCi/g	0	0.16667
Radium-226	Unknown	075500	481152.4441	1346513.712	0.53 J		pCi/g	0	0.5
Radium-226	Unknown	005496	481029.3843	1346531.053	0.6 -		pCi/g	0	0.16667
Radium-226	CIS	SD-31-004	481170.3832	1346433.052	0.6 UNV		pCi/g	0	0.25
Radium-226	Unknown	005493	481629.38	1346131.047	0.7 J		pCi/g	0	0.16667
Radium-226	RI/FS	123275	481177.02	1346409.88	0.717 -		pCi/g	0	0.5
Radium-226	RI/FS	123273	481295.48	1346363.17	0.756 -		pCi/g	0	0.5
Radium-226	Unknown	005435	482029.3832	1346431.042	0.8 J		pCi/g	0	0.16667
Radium-226	RI/FS	123411	481060.07	1346522.41	0.963 -		pCi/g	0	0.5
Radium-226	CIS	SD-31-005	481260.3827	1346385.051	1 UNV		pCi/g	0	0.5
Radium-226	CIS	SD-26-018	482082.3812	1346241.042	1.2 NV		pCi/g	0	0.25
Radium-226	CIS	SD-31-003	481117.3841	1346513.052	1.3 NV		pCi/g	0	0.5
Radium-226	RI/FS	123276	481481	1346307	1.36 -		pCi/g	0	0.5
Radium-226	RI/FS	123287	481902	1346539	1.8 -		pCi/g	0	0.5
Radium-226	RI/FS	123278	481681	1346320	1.99 -		pCi/g	0	0.5
Radium-228	Unknown	075500	481152.4441	1346513.712	0.5 UJ		pCi/g	0	0.5
Radium-228	RI/FS	123275	481177.02	1346409.88	0.54 -		pCi/g	0	0.5
Radium-228	RI/FS	123273	481295.48	1346363.17	0.593 -		pCi/g	0	0.5
Radium-228	Unknown	005496	481029.3843	1346531.053	0.6 -		pCi/g	0	0.16667
Radium-228	Unknown	005493	481629.38	1346131.047	0.6 J		pCi/g	0	0.16667
Radium-228	Unknown	005435	482029.3832	1346431.042	0.6 J		pCi/g	0	0.16667
Radium-228	Unknown	005125	482029.3843	1346531.042	0.8 UJ		pCi/g	0	0.16667

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Radium-228	Unknown	005126	482029.3843	1346531.042	0.9	UJ	pCi/g	0	0.16667
Radium-228	RI/FS	123411	481060.07	1346522.41	0.948	-	pCi/g	0	0.5
Radium-228	RI/FS	123276	481481	1346307	1.45	-	pCi/g	0	0.5
Radium-228	RI/FS	123287	481902	1346539	2.08	-	pCi/g	0	0.5
Radium-228	RI/FS	123278	481681	1346320	2.1	-	pCi/g	0	0.5
Selenium	RI/FS	123411	481060.07	1346522.41	0.33	UJ	mg/kg	0	0.5
Selenium	RI/FS	123273	481295.48	1346363.17	0.35	UJ	mg/kg	0	0.5
Selenium	RI/FS	123275	481177.02	1346409.88	0.43	UJ	mg/kg	0	0.5
Selenium	RI/FS	123276	481481	1346307	0.44	UJ	mg/kg	0	0.5
Selenium	Unknown	061072	481074.26	1346563.08	0.45	U	mg/kg	0	0.5
Selenium	Unknown	061037	481679.46	1346379.58	0.45	U	mg/kg	0	0.5
Selenium	Unknown	061058	481176.96	1346465.78	0.48	U	mg/kg	0	0.5
Selenium	Unknown	061023	482073.77	1346590.37	0.5	U	mg/kg	0	0.5
Selenium	Unknown	061030	481873.87	1346584.87	0.5	U	mg/kg	0	0.5
Selenium	Unknown	061044	481479.56	1346374.08	0.54	U	mg/kg	0	0.5
Selenium	RI/FS	123287	481902	1346539	0.63	UJ	mg/kg	0	0.5
Selenium	RI/FS	123278	481681	1346320	4.9	UJ	mg/kg	0	0.5
Silver	RI/FS	123275	481177.02	1346409.88	2.2	U	mg/kg	0	0.5
Silver	RI/FS	123273	481295.48	1346363.17	2.2	U	mg/kg	0	0.5
Silver	RI/FS	123411	481060.07	1346522.41	2.7	-	mg/kg	0	0.5
Silver	RI/FS	123287	481902	1346539	3.6	-	mg/kg	0	0.5
Silver	RI/FS	123276	481481	1346307	4.2	-	mg/kg	0	0.5
Silver	RI/FS	123278	481681	1346320	4.9	UJ	mg/kg	0	0.5
Silver	Unknown	061044	481479.56	1346374.08	6.7	J	mg/kg	0	0.5
Silver	Unknown	061030	481873.87	1346584.87	7.2	-	mg/kg	0	0.5
Silver	Unknown	061037	481679.46	1346379.58	7.6	-	mg/kg	0	0.5
Silver	Unknown	061072	481074.26	1346563.08	9.4	-	mg/kg	0	0.5
Silver	Unknown	061023	482073.77	1346590.37	10.3	-	mg/kg	0	0.5
Silver	Unknown	061058	481176.96	1346465.78	10.3	-	mg/kg	0	0.5
Strontium-90	RI/FS	123276	481481	1346307	0.22	UJ	pCi/g	0	0.5
Strontium-90	RI/FS	123287	481902	1346539	0.22	UJ	pCi/g	0	0.5
Strontium-90	RI/FS	123275	481177.02	1346409.88	0.23	UJ	pCi/g	0	0.5
Strontium-90	RI/FS	123273	481295.48	1346363.17	0.23	UJ	pCi/g	0	0.5
Strontium-90	RI/FS	123278	481681	1346320	0.23	UJ	pCi/g	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Strontium-90	RI/FS	123411	481060.07	1346522.41	0.28	UJ	pCi/g	0	0.5
Strontium-90	Unknown	005126	482029.3843	1346531.042	0.5	-	pCi/g	0	0.16667
Strontium-90	Unknown	005496	481029.3843	1346531.053	0.5	U	pCi/g	0	0.16667
Strontium-90	Unknown	005493	481629.38	1346131.047	0.5	U	pCi/g	0	0.16667
Strontium-90	Unknown	005435	482029.3832	1346431.042	0.5	U	pCi/g	0	0.16667
Strontium-90	Unknown	005125	482029.3843	1346531.042	0.6	-	pCi/g	0	0.16667
Strontium-90	Unknown	075500	481152.4441	1346513.712	1.01	J	pCi/g	0	0.5
Technetium-99	RI/FS	123411	481060.07	1346522.41	0.45	UJ	pCi/g	0	0.5
Technetium-99	RI/FS	123276	481481	1346307	0.48	UJ	pCi/g	0	0.5
Technetium-99	RI/FS	123275	481177.02	1346409.88	0.49	UJ	pCi/g	0	0.5
Technetium-99	RI/FS	123273	481295.48	1346363.17	0.5	UJ	pCi/g	0	0.5
Technetium-99	RI/FS	123278	481681	1346320	0.606	J	pCi/g	0	0.5
Technetium-99	Unknown	005493	481629.38	1346131.047	0.9	U	pCi/g	0	0.16667
Technetium-99	Unknown	005435	482029.3832	1346431.042	0.9	U	pCi/g	0	0.16667
Technetium-99	Unknown	005125	482029.3843	1346531.042	0.9	U	pCi/g	0	0.16667
Technetium-99	Unknown	005126	482029.3843	1346531.042	0.9	U	pCi/g	0	0.16667
Technetium-99	Unknown	075500	481152.4441	1346513.712	0.9	UJ	pCi/g	0	0.5
Technetium-99	Unknown	005496	481029.3843	1346531.053	0.9	UJ	pCi/g	0	0.16667
Technetium-99	RI/FS	123287	481902	1346539	1.13	J	pCi/g	0	0.5
Tetrachloroethene	Unknown	061077	481074.26	1346563.08	6	U	ug/kg	1.5	2
Tetrachloroethene	Unknown	061028	482073.77	1346590.37	6	U	ug/kg	1.5	2
Tetrachloroethene	Unknown	061035	481873.87	1346584.87	6	U	ug/kg	1.5	2
Tetrachloroethene	Unknown	061042	481679.46	1346379.58	6	U	ug/kg	1.5	2
Tetrachloroethene	Unknown	061049	481479.56	1346374.08	6	U	ug/kg	1.5	2
Tetrachloroethene	RI/FS	123411	481060.07	1346522.41	11	U	ug/kg	0	0.5
Tetrachloroethene	RI/FS	123275	481177.02	1346409.88	11	U	ug/kg	0	0.5
Tetrachloroethene	RI/FS	123273	481295.48	1346363.17	11	U	ug/kg	0	0.5
Tetrachloroethene	RI/FS	123276	481481	1346307	11	U	ug/kg	0	0.5
Tetrachloroethene	RI/FS	123287	481902	1346539	16	U	ug/kg	0	0.5
Tetrachloroethene	RI/FS	123278	481681	1346320	28	U	ug/kg	0	0.5
Thallium	RI/FS	123411	481060.07	1346522.41	0.33	UJ	mg/kg	0	0.5
Thallium	RI/FS	123273	481295.48	1346363.17	0.35	UJ	mg/kg	0	0.5
Thallium	RI/FS	123275	481177.02	1346409.88	0.43	UJ	mg/kg	0	0.5
Thallium	Unknown	061044	481479.56	1346374.08	0.44	U	mg/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Thallium	RI/FS	123276	481481	1346307	0.44 UJ		mg/kg	0	0.5
Thallium	Unknown	061072	481074.26	1346563.08	0.45 UJ		mg/kg	0	0.5
Thallium	Unknown	061037	481679.46	1346379.58	0.45 UJ		mg/kg	0	0.5
Thallium	Unknown	061058	481176.96	1346465.78	0.48 UJ		mg/kg	0	0.5
Thallium	Unknown	061030	481873.87	1346584.87	0.5 UJ		mg/kg	0	0.5
Thallium	RI/FS	123287	481902	1346539	0.63 UJ		mg/kg	0	0.5
Thallium	Unknown	061023	482073.77	1346590.37	0.68 J		mg/kg	0	0.5
Thallium	RI/FS	123278	481681	1346320	0.98 UJ		mg/kg	0	0.5
Thorium-228	RI/FS	123273	481295.48	1346363.17	0.47 J		pCi/g	0	0.5
Thorium-228	Unknown	005496	481029.3843	1346531.053	0.6 U		pCi/g	0	0.16667
Thorium-228	RI/FS	123411	481060.07	1346522.41	0.63 -		pCi/g	0	0.5
Thorium-228	Unknown	005493	481629.38	1346131.047	0.7 -		pCi/g	0	0.16667
Thorium-228	RI/FS	123275	481177.02	1346409.88	0.712 J		pCi/g	0	0.5
Thorium-228	Unknown	005125	482029.3843	1346531.042	0.9 -		pCi/g	0	0.16667
Thorium-228	Unknown	005126	482029.3843	1346531.042	0.9 -		pCi/g	0	0.16667
Thorium-228	Unknown	005435	482029.3832	1346431.042	1.2 J		pCi/g	0	0.16667
Thorium-228	RI/FS	123278	481681	1346320	1.89 J		pCi/g	0	0.5
Thorium-228	Unknown	075500	481152.4441	1346513.712	2 J		pCi/g	0	0.5
Thorium-228	RI/FS	123287	481902	1346539	2.37 J		pCi/g	0	0.5
Thorium-228	RI/FS	123276	481481	1346307	3.28 J		pCi/g	0	0.5
Thorium-230	Unknown	005496	481029.3843	1346531.053	1.1 -		pCi/g	0	0.16667
Thorium-230	Unknown	075500	481152.4441	1346513.712	1.17 J		pCi/g	0	0.5
Thorium-230	RI/FS	123275	481177.02	1346409.88	1.37 J		pCi/g	0	0.5
Thorium-230	Unknown	005493	481629.38	1346131.047	1.4 -		pCi/g	0	0.16667
Thorium-230	RI/FS	123273	481295.48	1346363.17	1.44 J		pCi/g	0	0.5
Thorium-230	RI/FS	123411	481060.07	1346522.41	1.76 -		pCi/g	0	0.5
Thorium-230	Unknown	005126	482029.3843	1346531.042	2 -		pCi/g	0	0.16667
Thorium-230	Unknown	005435	482029.3832	1346431.042	2 J		pCi/g	0	0.16667
Thorium-230	Unknown	005125	482029.3843	1346531.042	2.1 -		pCi/g	0	0.16667
Thorium-230	RI/FS	123276	481481	1346307	8.21 J		pCi/g	0	0.5
Thorium-230	RI/FS	123287	481902	1346539	17.5 J		pCi/g	0	0.5
Thorium-230	RI/FS	123278	481681	1346320	35.7 J		pCi/g	0	0.5
Thorium-232	CIS	SD-31-006	481353.3823	1346348.05	0.3 NV		pCi/g	0	0.5
Thorium-232	CIS	SD-31-004	481170.3832	1346433.052	0.3 UNV		pCi/g	0	0.25

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Thorium-232	RI/FS	123273	481295.48	1346363.17	0.588	J	pCi/g	0	0.5
Thorium-232	Unknown	075500	481152.4441	1346513.712	0.6	U	pCi/g	0	0.5
Thorium-232	Unknown	005496	481029.3843	1346531.053	0.6	U	pCi/g	0	0.16667
Thorium-232	RI/FS	123275	481177.02	1346409.88	0.611	J	pCi/g	0	0.5
Thorium-232	Unknown	005125	482029.3843	1346531.042	0.7	-	pCi/g	0	0.16667
Thorium-232	Unknown	005493	481629.38	1346131.047	0.8	-	pCi/g	0	0.16667
Thorium-232	Unknown	005126	482029.3843	1346531.042	0.8	-	pCi/g	0	0.16667
Thorium-232	Unknown	005435	482029.3832	1346431.042	0.8	J	pCi/g	0	0.16667
Thorium-232	RI/FS	123411	481060.07	1346522.41	0.83	-	pCi/g	0	0.5
Thorium-232	CIS	SD-31-005	481260.3827	1346385.051	1.4	UNV	pCi/g	0	0.5
Thorium-232	RI/FS	123278	481681	1346320	1.65	J	pCi/g	0	0.5
Thorium-232	RI/FS	123287	481902	1346539	1.66	J	pCi/g	0	0.5
Thorium-232	RI/FS	123276	481481	1346307	2.54	J	pCi/g	0	0.5
Thorium-232	CIS	SD-26-018	482082.3812	1346241.042	3.4	UNV	pCi/g	0	0.25
Thorium-232	CIS	SD-31-003	481117.3841	1346513.052	4.3	UNV	pCi/g	0	0.5
Toluene	Unknown	061035	481873.87	1346584.87	1	J	ug/kg	1.5	2
Toluene	RI/FS	123273	481295.48	1346363.17	4	J	ug/kg	0	0.5
Toluene	RI/FS	123287	481902	1346539	5	J	ug/kg	0	0.5
Toluene	Unknown	061077	481074.26	1346563.08	6	U	ug/kg	1.5	2
Toluene	Unknown	061028	482073.77	1346590.37	6	U	ug/kg	1.5	2
Toluene	Unknown	061042	481679.46	1346379.58	6	U	ug/kg	1.5	2
Toluene	Unknown	061049	481479.56	1346374.08	6	U	ug/kg	1.5	2
Toluene	RI/FS	123276	481481	1346307	10	J	ug/kg	0	0.5
Toluene	RI/FS	123411	481060.07	1346522.41	11	U	ug/kg	0	0.5
Toluene	RI/FS	123275	481177.02	1346409.88	11	U	ug/kg	0	0.5
Toluene	RI/FS	123278	481681	1346320	28	U	ug/kg	0	0.5
Toxaphene	Unknown	061037	481679.46	1346379.58	180	U	ug/kg	0	0.5
Toxaphène	Unknown	061072	481074.26	1346563.08	190	U	ug/kg	0	0.5
Toxaphene	Unknown	061044	481479.56	1346374.08	190	U	ug/kg	0	0.5
Toxaphene	Unknown	061023	482073.77	1346590.37	200	U	ug/kg	0	0.5
Toxaphene	Unknown	061030	481873.87	1346584.87	200	U	ug/kg	0	0.5
Toxaphene	Unknown	061058	481176.96	1346465.78	200	U	ug/kg	0	0.5
Trichloroethene	Unknown	061077	481074.26	1346563.08	6	U	ug/kg	1.5	2
Trichloroethene	Unknown	061028	482073.77	1346590.37	6	U	ug/kg	1.5	2

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Trichloroethene	Unknown	061035	481873.87	1346584.87	6 U		ug/kg	1.5	2
Trichloroethene	Unknown	061042	481679.46	1346379.58	6 U		ug/kg	1.5	2
Trichloroethene	Unknown	061049	481479.56	1346374.08	6 U		ug/kg	1.5	2
Trichloroethene	RI/FS	123411	481060.07	1346522.41	11 U		ug/kg	0	0.5
Trichloroethene	RI/FS	123275	481177.02	1346409.88	11 U		ug/kg	0	0.5
Trichloroethene	RI/FS	123273	481295.48	1346363.17	11 U		ug/kg	0	0.5
Trichloroethene	RI/FS	123276	481481	1346307	11 U		ug/kg	0	0.5
Trichloroethene	RI/FS	123287	481902	1346539	16 U		ug/kg	0	0.5
Trichloroethene	RI/FS	123278	481681	1346320	28 U		ug/kg	0	0.5
Uranium, Total	Unknown	075500	481152.4441	1346513.712	1.39 J		mg/kg	0	0.5
Uranium, Total	Unknown	005493	481629.38	1346131.047	2 J		mg/kg	0	0.16667
Uranium, Total	RI/FS	123275	481177.02	1346409.88	5.66 -		mg/kg	0	0.5
Uranium, Total	RI/FS	123273	481295.48	1346363.17	5.82 -		mg/kg	0	0.5
Uranium, Total	Unknown	005496	481029.3843	1346531.053	9 -		mg/kg	0	0.16667
Uranium, Total	CIS	SD-31-005	481260.3827	1346385.051	10.132 NV		pCi/g	0	0.5
Uranium, Total	Unknown	075509	481152.4441	1346513.712	11 UNV		mg/kg	0	0.5
Uranium, Total	Unknown	005126	482029.3843	1346531.042	12.7942 NV		pCi/g	0	0.16667
Uranium, Total	Unknown	005435	482029.3832	1346431.042	13 J		mg/kg	0	0.16667
Uranium, Total	CIS	SD-31-003	481117.3841	1346513.052	14.304 NV		pCi/g	0	0.5
Uranium, Total	Unknown	005125	482029.3843	1346531.042	15.7743 NV		pCi/g	0	0.16667
Uranium, Total	CIS	SD-26-018	482082.3812	1346241.042	18.178 NV		pCi/g	0	0.25
Uranium, Total	CIS	SD-31-004	481170.3832	1346433.052	19.37 NV		pCi/g	0	0.25
Uranium, Total	RI/FS	123411	481060.07	1346522.41	22 -		mg/kg	0	0.5
Uranium, Total	CIS	SD-31-006	481353.3823	1346348.05	37.25 NV		pCi/g	0	0.5
Uranium, Total	RI/FS	123276	481481	1346307	48.7 -		mg/kg	0	0.5
Uranium, Total	RI/FS	123287	481902	1346539	103 -		mg/kg	0	0.5
Uranium, Total	RI/FS	123278	481681	1346320	124 -		mg/kg	0	0.5
Uranium-234	Unknown	075500	481152.4441	1346513.712	0.684 -		pCi/g	0	0.5
Uranium-234	Unknown	005493	481629.38	1346131.047	0.7 -		pCi/g	0	0.16667
Uranium-234	RI/FS	123275	481177.02	1346409.88	0.983 -		pCi/g	0	0.5
Uranium-234	Unknown	005496	481029.3843	1346531.053	1.5 -		pCi/g	0	0.16667
Uranium-234	RI/FS	123273	481295.48	1346363.17	1.56 -		pCi/g	0	0.5
Uranium-234	RI/FS	123411	481060.07	1346522.41	1.71 -		pCi/g	0	0.5
Uranium-234	Unknown	005435	482029.3832	1346431.042	2.3 J		pCi/g	0	0.16667

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Uranium-234	Unknown	005126	482029.3843	1346531.042	2.6	J	pCi/g	0	0.16667
Uranium-234	Unknown	005125	482029.3843	1346531.042	2.9	J	pCi/g	0	0.16667
Uranium-234	RI/FS	123276	481481	1346307	4.15	-	pCi/g	0	0.5
Uranium-234	RI/FS	123278	481681	1346320	8.25	-	pCi/g	0	0.5
Uranium-234	RI/FS	123287	481902	1346539	8.97	-	pCi/g	0	0.5
Uranium-235/236	RI/FS	123273	481295.48	1346363.17	0.068	J	pCi/g	0	0.5
Uranium-235/236	RI/FS	123275	481177.02	1346409.88	0.07	UJ	pCi/g	0	0.5
Uranium-235/236	RI/FS	123411	481060.07	1346522.41	0.12	-	pCi/g	0	0.5
Uranium-235/236	RI/FS	123276	481481	1346307	0.172	J	pCi/g	0	0.5
Uranium-235/236	RI/FS	123278	481681	1346320	0.591	J	pCi/g	0	0.5
Uranium-235/236	Unknown	075500	481152.4441	1346513.712	0.6	U	pCi/g	0	0.5
Uranium-235/236	Unknown	005496	481029.3843	1346531.053	0.6	U	pCi/g	0	0.16667
Uranium-235/236	Unknown	005493	481629.38	1346131.047	0.6	U	pCi/g	0	0.16667
Uranium-235/236	Unknown	005126	482029.3843	1346531.042	0.6	U	pCi/g	0	0.16667
Uranium-235/236	Unknown	005435	482029.3832	1346431.042	0.6	UJ	pCi/g	0	0.16667
Uranium-235/236	Unknown	005125	482029.3843	1346531.042	0.6	UJ	pCi/g	0	0.16667
Uranium-235/236	RI/FS	123287	481902	1346539	0.642	-	pCi/g	0	0.5
Uranium-238	Unknown	005493	481629.38	1346131.047	0.9	-	pCi/g	0	0.16667
Uranium-238	Unknown	075500	481152.4441	1346513.712	0.936	-	pCi/g	0	0.5
Uranium-238	RI/FS	123275	481177.02	1346409.88	1.67	-	pCi/g	0	0.5
Uranium-238	RI/FS	123273	481295.48	1346363.17	2.25	-	pCi/g	0	0.5
Uranium-238	Unknown	005496	481029.3843	1346531.053	3.2	-	pCi/g	0	0.16667
Uranium-238	CIS	SD-31-005	481260.3827	1346385.051	3.4	NV	pCi/g	0	0.5
Uranium-238	Unknown	005126	482029.3843	1346531.042	4.2	J	pCi/g	0	0.16667
Uranium-238	CIS	SD-31-003	481117.3841	1346513.052	4.8	NV	pCi/g	0	0.5
Uranium-238	Unknown	005435	482029.3832	1346431.042	4.9	J	pCi/g	0	0.16667
Uranium-238	Unknown	005125	482029.3843	1346531.042	5.2	J	pCi/g	0	0.16667
Uranium-238	RI/FS	123411	481060.07	1346522.41	5.78	-	pCi/g	0	0.5
Uranium-238	CIS	SD-26-018	482082.3812	1346241.042	6.1	NV	pCi/g	0	0.25
Uranium-238	CIS	SD-31-004	481170.3832	1346433.052	6.5	UNV	pCi/g	0	0.25
Uranium-238	CIS	SD-31-006	481353.3823	1346348.05	12.5	UNV	pCi/g	0	0.5
Uranium-238	RI/FS	123276	481481	1346307	16.9	-	pCi/g	0	0.5
Uranium-238	RI/FS	123278	481681	1346320	34.8	-	pCi/g	0	0.5
Uranium-238	RI/FS	123287	481902	1346539	34.8	-	pCi/g	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Vanadium	Unknown	061037	481679.46	1346379.58	10.9	-	mg/kg	0	0.5
Vanadium	RI/FS	123278	481681	1346320	13.9	J	mg/kg	0	0.5
Vanadium	Unknown	061044	481479.56	1346374.08	15.4	-	mg/kg	0	0.5
Vanadium	RI/FS	123273	481295.48	1346363.17	15.6	-	mg/kg	0	0.5
Vanadium	RI/FS	123275	481177.02	1346409.88	17.1	-	mg/kg	0	0.5
Vanadium	RI/FS	123411	481060.07	1346522.41	17.9	-	mg/kg	0	0.5
Vanadium	Unknown	061072	481074.26	1346563.08	18	-	mg/kg	0	0.5
Vanadium	Unknown	061058	481176.96	1346465.78	18.9	-	mg/kg	0	0.5
Vanadium	Unknown	061023	482073.77	1346590.37	22.2	-	mg/kg	0	0.5
Vanadium	Unknown	061030	481873.87	1346584.87	23.8	-	mg/kg	0	0.5
Vanadium	RI/FS	123276	481481	1346307	24.2	-	mg/kg	0	0.5
Vanadium	RI/FS	123287	481902	1346539	36.8	-	mg/kg	0	0.5
Vinyl chloride	RI/FS	123411	481060.07	1346522.41	11	U	ug/kg	0	0.5
Vinyl chloride	RI/FS	123275	481177.02	1346409.88	11	U	ug/kg	0	0.5
Vinyl chloride	RI/FS	123273	481295.48	1346363.17	11	U	ug/kg	0	0.5
Vinyl chloride	RI/FS	123276	481481	1346307	11	U	ug/kg	0	0.5
Vinyl chloride	Unknown	061077	481074.26	1346563.08	12	U	ug/kg	1.5	2
Vinyl chloride	Unknown	061028	482073.77	1346590.37	12	U	ug/kg	1.5	2
Vinyl chloride	Unknown	061042	481679.46	1346379.58	12	U	ug/kg	1.5	2
Vinyl chloride	Unknown	061049	481479.56	1346374.08	12	U	ug/kg	1.5	2
Vinyl chloride	Unknown	061035	481873.87	1346584.87	13	U	ug/kg	1.5	2
Vinyl chloride	RI/FS	123287	481902	1346539	16	U	ug/kg	0	0.5
Vinyl chloride	RI/FS	123278	481681	1346320	28	U	ug/kg	0	0.5
Xylenes, Total	RI/FS	123273	481295.48	1346363.17	2	J	ug/kg	0	0.5
Xylenes, Total	RI/FS	123276	481481	1346307	2	J	ug/kg	0	0.5
Xylenes, Total	Unknown	061077	481074.26	1346563.08	6	U	ug/kg	1.5	2
Xylenes, Total	Unknown	061028	482073.77	1346590.37	6	U	ug/kg	1.5	2
Xylenes, Total	Unknown	061035	481873.87	1346584.87	6	U	ug/kg	1.5	2
Xylenes, Total	Unknown	061042	481679.46	1346379.58	6	U	ug/kg	1.5	2
Xylenes, Total	Unknown	061049	481479.56	1346374.08	6	U	ug/kg	1.5	2
Xylenes, Total	RI/FS	123411	481060.07	1346522.41	11	U	ug/kg	0	0.5
Xylenes, Total	RI/FS	123275	481177.02	1346409.88	11	U	ug/kg	0	0.5
Xylenes, Total	RI/FS	123287	481902	1346539	16	U	ug/kg	0	0.5
Xylenes, Total	RI/FS	123278	481681	1346320	28	U	ug/kg	0	0.5

**APPENDIX A-1**  
**HISTORICAL DATA FOR THE NORTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Zinc	Unknown	061072	481074.26	1346563.08	27.7 J		mg/kg	0	0.5
Zinc	Unknown	061037	481679.46	1346379.58	28.9 J		mg/kg	0	0.5
Zinc	Unknown	061044	481479.56	1346374.08	32.2 J		mg/kg	0	0.5
Zinc	RI/FS	123275	481177.02	1346409.88	32.3 -		mg/kg	0	0.5
Zinc	RI/FS	123273	481295.48	1346363.17	33.5 -		mg/kg	0	0.5
Zinc	RI/FS	123411	481060.07	1346522.41	39.9 -		mg/kg	0	0.5
Zinc	Unknown	061058	481176.96	1346465.78	40.9 J		mg/kg	0	0.5
Zinc	RI/FS	123278	481681	1346320	42.4 J		mg/kg	0	0.5
Zinc	Unknown	061023	482073.77	1346590.37	42.5 J		mg/kg	0	0.5
Zinc	RI/FS	123276	481481	1346307	43.6 -		mg/kg	0	0.5
Zinc	Unknown	061030	481873.87	1346584.87	46.7 J		mg/kg	0	0.5
Zinc	RI/FS	123287	481902	1346539	72.6 -		mg/kg	0	0.5

0900000

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
1,1,1-Trichloroethane	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
1,1,1-Trichloroethane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
1,1,1-Trichloroethane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
1,1,2,2-Tetrachloroethane	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
1,1,2,2-Tetrachloroethane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
1,1,2,2-Tetrachloroethane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
1,1,2-Trichloroethane	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
1,1,2-Trichloroethane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
1,1,2-Trichloroethane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
1,1-Dichloroethane	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
1,1-Dichloroethane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
1,1-Dichloroethane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
1,1-Dichloroethene	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
1,1-Dichloroethene	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
1,1-Dichloroethene	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
1,2,4-Trichlorobenzene	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
1,2,4-Trichlorobenzene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
1,2,4-Trichlorobenzene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
1,2-Dichlorobenzene	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
1,2-Dichlorobenzene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
1,2-Dichlorobenzene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
1,2-Dichloroethane	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
1,2-Dichloroethane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
1,2-Dichloroethane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
1,2-Dichloroethene (Total)	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
1,2-Dichloroethene (Total)	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
1,2-Dichloroethene (Total)	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
1,2-Dichloropropane	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
1,2-Dichloropropane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
1,2-Dichloropropane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
1,3-Dichlorobenzene	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
1,3-Dichlorobenzene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
1,3-Dichlorobenzene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
1,4-Dichlorobenzene	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
1,4-Dichlorobenzene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
1,4-Dichlorobenzene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
2,4,5-Trichlorophenol	RI/FS	121045	479544.93	1346398.61	980	U	ug/kg	0	0.5
2,4,5-Trichlorophenol	RI/FS	118794	479636.3832	1346433.968	2000	U	ug/kg	0	0.5
2,4,5-Trichlorophenol	Unknown	009147	479636.3832	1346433.968	2300	U	ug/kg	0	0.5
2,4,6-Trichlorophenol	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
2,4,6-Trichlorophenol	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
2,4,6-Trichlorophenol	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
2,4-Dichlorophenol	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
2,4-Dichlorophenol	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
2,4-Dichlorophenol	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
2,4-Dimethylphenol	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
2,4-Dimethylphenol	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
2,4-Dimethylphenol	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
2,4-Dinitrophenol	RI/FS	118794	479636.3832	1346433.968	2000	U	ug/kg	0	0.5
2,4-Dinitrophenol	Unknown	009147	479636.3832	1346433.968	2300	UJ	ug/kg	0	0.5
2,4-Dinitrotoluene	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
2,4-Dinitrotoluene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
2,4-Dinitrotoluene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
2,6-Dinitrotoluene	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
2,6-Dinitrotoluene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
2,6-Dinitrotoluene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
2-Butanone	RI/FS	121045	479544.93	1346398.61	12	UJ	ug/kg	0	0.5
2-Butanone	Unknown	009147	479636.3832	1346433.968	15	U	ug/kg	0	0.5
2-Chloronaphthalene	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
2-Chloronaphthalene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
2-Chloronaphthalene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
2-Chlorophenol	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
2-Chlorophenol	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
2-Chlorophenol	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
2-Hexanone	RI/FS	121045	479544.93	1346398.61	12	U	ug/kg	0	0.5
2-Hexanone	RI/FS	118794	479636.3832	1346433.968	12	U	ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
2-Hexanone	Unknown	009147	479636.3832	1346433.968	15 U		ug/kg	0	0.5
2-Methylnaphthalene	RI/FS	121045	479544.93	1346398.61	390 UJ		ug/kg	0	0.5
2-Methylnaphthalene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
2-Methylnaphthalene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
2-Nitroaniline	RI/FS	121045	479544.93	1346398.61	980 UJ		ug/kg	0	0.5
2-Nitroaniline	RI/FS	118794	479636.3832	1346433.968	2000 U		ug/kg	0	0.5
2-Nitroaniline	Unknown	009147	479636.3832	1346433.968	2300 U		ug/kg	0	0.5
2-Nitrophenol	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
2-Nitrophenol	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
2-Nitrophenol	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
3,3'-Dichlorobenzidine	RI/FS	121045	479544.93	1346398.61	390 UJ		ug/kg	0	0.5
3,3'-Dichlorobenzidine	RI/FS	118794	479636.3832	1346433.968	790 U		ug/kg	0	0.5
3,3'-Dichlorobenzidine	Unknown	009147	479636.3832	1346433.968	960 U		ug/kg	0	0.5
3-Nitroaniline	RI/FS	121045	479544.93	1346398.61	980 U		ug/kg	0	0.5
3-Nitroaniline	RI/FS	118794	479636.3832	1346433.968	2000 U		ug/kg	0	0.5
3-Nitroaniline	Unknown	009147	479636.3832	1346433.968	2300 U		ug/kg	0	0.5
4,4'-DDD	RI/FS	121045	479544.93	1346398.61	7.8 U		ug/kg	0	0.5
4,4'-DDD	Unknown	009147	479636.3832	1346433.968	24 U		ug/kg	0	0.5
4,4'-DDE	RI/FS	121045	479544.93	1346398.61	7.8 U		ug/kg	0	0.5
4,4'-DDE	Unknown	009147	479636.3832	1346433.968	24 U		ug/kg	0	0.5
4,4'-DDT	RI/FS	121045	479544.93	1346398.61	7.8 U		ug/kg	0	0.5
4,4'-DDT	Unknown	009147	479636.3832	1346433.968	24 U		ug/kg	0	0.5
4,6-Dinitro-2-methylphenol	RI/FS	121045	479544.93	1346398.61	980 UJ		ug/kg	0	0.5
4,6-Dinitro-2-methylphenol	RI/FS	118794	479636.3832	1346433.968	2000 U		ug/kg	0	0.5
4,6-Dinitro-2-methylphenol	Unknown	009147	479636.3832	1346433.968	2300 UJ		ug/kg	0	0.5
4-Bromophenyl phenyl ether	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
4-Bromophenyl phenyl ether	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
4-Bromophenyl phenyl ether	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
4-Chloro-3-methylphenol	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
4-Chloro-3-methylphenol	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
4-Chloro-3-methylphenol	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
4-Chlorophenylphenyl ether	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
4-Chlorophenylphenyl ether	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
4-Chlorophenylphenyl ether	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
4-Methyl-2-pantanone	RI/FS	118794	479636.3832	1346433.968	12	U	ug/kg	0	0.5
4-Methyl-2-pantanone	RI/FS	121045	479544.93	1346398.61	12	UJ	ug/kg	0	0.5
4-Methyl-2-pantanone	Unknown	009147	479636.3832	1346433.968	15	U	ug/kg	0	0.5
4-Nitroaniline	RI/FS	121045	479544.93	1346398.61	980	U	ug/kg	0	0.5
4-Nitroaniline	RI/FS	118794	479636.3832	1346433.968	2000	U	ug/kg	0	0.5
4-Nitroaniline	Unknown	009147	479636.3832	1346433.968	2300	U	ug/kg	0	0.5
4-Nitrophenol	RI/FS	121045	479544.93	1346398.61	980	U	ug/kg	0	0.5
4-Nitrophenol	RI/FS	118794	479636.3832	1346433.968	2000	U	ug/kg	0	0.5
4-Nitrophenol	Unknown	009147	479636.3832	1346433.968	2300	UJ	ug/kg	0	0.5
Acenaphthene	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
Acenaphthene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
Acenaphthene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
Acenaphthylene	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
Acenaphthylene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
Acenaphthylene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
Acetone	RI/FS	121045	479544.93	1346398.61	12	U	ug/kg	0	0.5
Acetone	RI/FS	118794	479636.3832	1346433.968	12	U	ug/kg	0	0.5
Acetone	Unknown	009147	479636.3832	1346433.968	15	U	ug/kg	0	0.5
Aldrin	RI/FS	121045	479544.93	1346398.61	4	U	ug/kg	0	0.5
Aldrin	Unknown	009147	479636.3832	1346433.968	12	U	ug/kg	0	0.5
alpha-BHC	RI/FS	121045	479544.93	1346398.61	4	U	ug/kg	0	0.5
alpha-BHC	Unknown	009147	479636.3832	1346433.968	12	U	ug/kg	0	0.5
alpha-Chlordane	RI/FS	121045	479544.93	1346398.61	4	U	ug/kg	0	0.5
alpha-Chlordane	Unknown	009147	479636.3832	1346433.968	120	U	ug/kg	0	0.5
Aluminum	RI/FS	118794	479636.3832	1346433.968	1670	-	mg/kg	0	0.5
Aluminum	Unknown	009147	479636.3832	1346433.968	3353.38	NV	mg/kg	0	0.5
Aluminum	Unknown	009147	479636.3832	1346433.968	3920	-	mg/kg	0	0.5
Aluminum	RI/FS	121045	479544.93	1346398.61	6740	-	mg/kg	0	0.5
Anthracene	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
Anthracene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
Anthracene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
Antimony	Unknown	009147	479636.3832	1346433.968	2.5693	NV	mg/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Antimony	RI/FS	118794	479636.3832	1346433.968	2.9 UJ		mg/kg	0	0.5
Antimony	RI/FS	121045	479544.93	1346398.61	3.3 U		mg/kg	0	0.5
Aroclor-1016	RI/FS	121045	479544.93	1346398.61	78 U		ug/kg	0	0.5
Aroclor-1016	Unknown	009147	479636.3832	1346433.968	120 U		ug/kg	0	0.5
Aroclor-1221	Unknown	009147	479636.3832	1346433.968	120 U		ug/kg	0	0.5
Aroclor-1221	RI/FS	121045	479544.93	1346398.61	160 U		ug/kg	0	0.5
Aroclor-1232	RI/FS	121045	479544.93	1346398.61	78 U		ug/kg	0	0.5
Aroclor-1232	Unknown	009147	479636.3832	1346433.968	120 U		ug/kg	0	0.5
Aroclor-1242	RI/FS	121045	479544.93	1346398.61	78 U		ug/kg	0	0.5
Aroclor-1242	Unknown	009147	479636.3832	1346433.968	120 U		ug/kg	0	0.5
Aroclor-1248	RI/FS	121045	479544.93	1346398.61	78 U		ug/kg	0	0.5
Aroclor-1248	Unknown	009147	479636.3832	1346433.968	120 U		ug/kg	0	0.5
Aroclor-1254	RI/FS	121045	479544.93	1346398.61	78 U		ug/kg	0	0.5
Aroclor-1254	Unknown	009147	479636.3832	1346433.968	240 U		ug/kg	0	0.5
Aroclor-1260	RI/FS	121045	479544.93	1346398.61	78 U		ug/kg	0	0.5
Aroclor-1260	Unknown	009147	479636.3832	1346433.968	240 U		ug/kg	0	0.5
Arsenic	RI/FS	118794	479636.3832	1346433.968	3.7 -		mg/kg	0	0.5
Arsenic	RI/FS	121045	479544.93	1346398.61	4.7 -		mg/kg	0	0.5
Arsenic	Unknown	009147	479636.3832	1346433.968	6.5 J		mg/kg	0	0.5
Arsenic	Unknown	009147	479636.3832	1346433.968	14.5324 NV		mg/kg	0	0.5
Barium	Unknown	009147	479636.3832	1346433.968	31.2 -		mg/kg	0	0.5
Barium	RI/FS	118794	479636.3832	1346433.968	32.7 -		mg/kg	0	0.5
Barium	RI/FS	121045	479544.93	1346398.61	56.3 -		mg/kg	0	0.5
Barium	Unknown	009147	479636.3832	1346433.968	537.287 NV		mg/kg	0	0.5
Benzene	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
Benzene	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Benzene	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Benzo(a)anthracene	RI/FS	121045	479544.93	1346398.61	57 J		ug/kg	0	0.5
Benzo(a)anthracene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Benzo(a)anthracene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Benzo(a)pyrene	RI/FS	121045	479544.93	1346398.61	42 J		ug/kg	0	0.5
Benzo(a)pyrene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Benzo(a)pyrene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Benzo(b)fluoranthene	RI/FS	121045	479544.93	1346398.61	55 J		ug/kg	0	0.5
Benzo(b)fluoranthene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Benzo(b)fluoranthene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Benzo(g,h,i)perylene	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Benzo(g,h,i)perylene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Benzo(g,h,i)perylene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Benzo(k)fluoranthene	RI/FS	121045	479544.93	1346398.61	61 J		ug/kg	0	0.5
Benzo(k)fluoranthene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Benzo(k)fluoranthene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Benzoic acid	RI/FS	121045	479544.93	1346398.61	980 U		ug/kg	0	0.5
Benzoic acid	RI/FS	118794	479636.3832	1346433.968	2000 UJ		ug/kg	0	0.5
Benzoic acid	Unknown	009147	479636.3832	1346433.968	2300 U		ug/kg	0	0.5
Benzyl alcohol	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Benzyl alcohol	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Benzyl alcohol	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Beryllium	Unknown	009147	479636.3832	1346433.968	0.5		mg/kg	0	0.5
Beryllium	RI/FS	121045	479544.93	1346398.61	1.4		mg/kg	0	0.5
Beryllium	RI/FS	118794	479636.3832	1346433.968	2.7 J		mg/kg	0	0.5
Beryllium	Unknown	009147	479636.3832	1346433.968	12.9086 NV		mg/kg	0	0.5
beta-BHC	RI/FS	121045	479544.93	1346398.61	4 U		ug/kg	0	0.5
beta-BHC	Unknown	009147	479636.3832	1346433.968	130 UJ		ug/kg	0	0.5
bis(2-Chloroethoxy)methane	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
bis(2-Chloroethoxy)methane	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
bis(2-Chloroethoxy)methane	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
bis(2-Chloroethyl)ether	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
bis(2-Chloroethyl)ether	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
bis(2-Chloroethyl)ether	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
bis(2-Chloroisopropyl) ether	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
bis(2-Chloroisopropyl) ether	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
bis(2-Chloroisopropyl) ether	Unknown	009147	479636.3832	1346433.968	480 UJ		ug/kg	0	0.5
bis(2-Ethylhexyl)phthalate	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
bis(2-Ethylhexyl)phthalate	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
bis(2-Ethylhexyl)phthalate	Unknown	009147	479636.3832	1346433.968	590 U		ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Bromodichloromethane	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
Bromodichloromethane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Bromodichloromethane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Bromoform	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
Bromoform	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Bromoform	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Bromomethane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Bromomethane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Bromomethane	Unknown	009147	479636.3832	1346433.968	15 U		ug/kg	0	0.5
Butyl benzyl phthalate	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Butyl benzyl phthalate	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Butyl benzyl phthalate	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Cadmium	RI/FS	121045	479544.93	1346398.61	1.2 U		mg/kg	0	0.5
Cadmium	RI/FS	118794	479636.3832	1346433.968	1.2 U		mg/kg	0	0.5
Cadmium	Unknown	009147	479636.3832	1346433.968	3.9 -		mg/kg	0	0.5
Cadmium	Unknown	009147	479636.3832	1346433.968	16.9247 NV		mg/kg	0	0.5
Calcium	RI/FS	121045	479544.93	1346398.61	63900 -		mg/kg	0	0.5
Calcium	Unknown	009147	479636.3832	1346433.968	78700 -		mg/kg	0	0.5
Calcium	Unknown	009147	479636.3832	1346433.968	81840.8 NV		mg/kg	0	0.5
Calcium	RI/FS	118794	479636.3832	1346433.968	186000 -		mg/kg	0	0.5
Carbon disulfide	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
Carbon disulfide	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Carbon disulfide	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Carbon Tetrachloride	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
Carbon Tetrachloride	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Carbon Tetrachloride	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Cesium-137	RI/FS	121050	479544.93	1346398.61	0.2 J		pCi/g	0	0.5
Chlorobenzene	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
Chlorobenzene	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Chlorobenzene	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Chloroethane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Chloroethane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Chloroethane	Unknown	009147	479636.3832	1346433.968	15 U		ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Chloroform	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
Chloroform	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Chloroform	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Chloromethane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Chloromethane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Chloromethane	Unknown	009147	479636.3832	1346433.968	15 U		ug/kg	0	0.5
Chromium	RI/FS	118794	479636.3832	1346433.968	2.9 -		mg/kg	0	0.5
Chromium	RI/FS	121045	479544.93	1346398.61	7.8 J		mg/kg	0	0.5
Chromium	Unknown	009147	479636.3832	1346433.968	18.4 -		mg/kg	0	0.5
Chromium	Unknown	009147	479636.3832	1346433.968	66.4939 NV		mg/kg	0	0.5
Chrysene	RI/FS	121045	479544.93	1346398.61	75 J		ug/kg	0	0.5
Chrysene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Chrysene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
cis-1,3-Dichloropropene	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
cis-1,3-Dichloropropene	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
cis-1,3-Dichloropropene	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Cobalt	RI/FS	118794	479636.3832	1346433.968	4.1 -		mg/kg	0	0.5
Cobalt	RI/FS	121045	479544.93	1346398.61	5.8 -		mg/kg	0	0.5
Cobalt	Unknown	009147	479636.3832	1346433.968	6.5 -		mg/kg	0	0.5
Cobalt	Unknown	009147	479636.3832	1346433.968	125.616 NV		mg/kg	0	0.5
Copper	RI/FS	118794	479636.3832	1346433.968	10.6 -		mg/kg	0	0.5
Copper	RI/FS	121045	479544.93	1346398.61	13.3 -		mg/kg	0	0.5
Copper	Unknown	009147	479636.3832	1346433.968	14.5 -		mg/kg	0	0.5
Copper	Unknown	009147	479636.3832	1346433.968	76.2184 NV		mg/kg	0	0.5
Cyanide	RI/FS	121045	479544.93	1346398.61	0.3 U		mg/kg	0	0.5
Cyanide	RI/FS	118794	479636.3832	1346433.968	0.3 U		mg/kg	0	0.5
Cyanide	Unknown	009147	479636.3832	1346433.968	2.7 U		mg/kg	0	0.5
Cyanide	Unknown	009147	479636.3832	1346433.968	25.4249 NV		mg/kg	0	0.5
delta-BHC	RI/FS	121045	479544.93	1346398.61	4 U		ug/kg	0	0.5
delta-BHC	Unknown	009147	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Dibenzo(a,h)anthracene	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Dibenzo(a,h)anthracene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Dibenzo(a,h)anthracene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Dibenzofuran	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Dibenzofuran	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Dibenzofuran	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Dibromochloromethane	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
Dibromochloromethane	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Dibromochloromethane	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Dieldrin	RI/FS	121045	479544.93	1346398.61	7.8 U		ug/kg	0	0.5
Dieldrin	Unknown	009147	479636.3832	1346433.968	24 U		ug/kg	0	0.5
Diethyl phthalate	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Diethyl phthalate	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Diethyl phthalate	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Dimethyl phthalate	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Dimethyl phthalate	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Dimethyl phthalate	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Di-n-butyl phthalate	Unknown	009147	479636.3832	1346433.968	51 U		ug/kg	0	0.5
Di-n-butyl phthalate	RI/FS	118794	479636.3832	1346433.968	63 J		ug/kg	0	0.5
Di-n-butyl phthalate	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Di-n-octyl phthalate	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Di-n-octyl phthalate	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Di-n-octyl phthalate	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Endosulfan II	RI/FS	121045	479544.93	1346398.61	7.8 U		ug/kg	0	0.5
Endosulfan II	Unknown	009147	479636.3832	1346433.968	24 U		ug/kg	0	0.5
Endosulfan sulfate	RI/FS	121045	479544.93	1346398.61	7.8 U		ug/kg	0	0.5
Endosulfan sulfate	Unknown	009147	479636.3832	1346433.968	24 U		ug/kg	0	0.5
Endosulfan-l	RI/FS	121045	479544.93	1346398.61	4 U		ug/kg	0	0.5
Endosulfan-l	Unknown	009147	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Endrin	RI/FS	121045	479544.93	1346398.61	7.8 U		ug/kg	0	0.5
Endrin	Unknown	009147	479636.3832	1346433.968	24 U		ug/kg	0	0.5
Endrin aldehyde	RI/FS	121045	479544.93	1346398.61	7.8 U		ug/kg	0	0.5
Endrin ketone	RI/FS	121045	479544.93	1346398.61	7.8 U		ug/kg	0	0.5
Endrin ketone	Unknown	009147	479636.3832	1346433.968	24 U		ug/kg	0	0.5
Ethylbenzene	Unknown	009147	479636.3832	1346433.968	1 J		ug/kg	0	0.5
Ethylbenzene	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Ethylbenzene	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Fluoranthene	RI/FS	118794	479636.3832	1346433.968	56 J		ug/kg	0	0.5
Fluoranthene	RI/FS	121045	479544.93	1346398.61	160 J		ug/kg	0	0.5
Fluoranthene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Fluorene	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Fluorene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Fluorene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
gamma-BHC (Lindane)	RI/FS	121045	479544.93	1346398.61	4 U		ug/kg	0	0.5
gamma-BHC (Lindane)	Unknown	009147	479636.3832	1346433.968	12 U		ug/kg	0	0.5
gamma-Chlordane	RI/FS	121045	479544.93	1346398.61	4 U		ug/kg	0	0.5
gamma-Chlordane	Unknown	009147	479636.3832	1346433.968	120 U		ug/kg	0	0.5
Gross Alpha	RI/FS	118796	479636.3832	1346433.968	8.5 UNV		pCi/g		
Gross Alpha	RI/FS	121050	479544.93	1346398.61	9 NV		pCi/g	0	0.5
Gross Alpha	Unknown	009038	479636.3832	1346433.968	9 NV		pCi/g	0	0.5
Gross Alpha	Unknown	009153	479636.3832	1346433.968	15 NV		pCi/g	0	0.5
Gross Alpha	RI/FS	118765	479636.3832	1346433.968	89 UNV		pCi/L		
Gross Beta	Unknown	009153	479636.3832	1346433.968	9 UNV		pCi/g	0	0.5
Gross Beta	Unknown	009038	479636.3832	1346433.968	13 NV		pCi/g	0	0.5
Gross Beta	RI/FS	118796	479636.3832	1346433.968	16 UNV		pCi/g		
Gross Beta	RI/FS	121050	479544.93	1346398.61	22.5 NV		pCi/g	0	0.5
Gross Beta	RI/FS	118765	479636.3832	1346433.968	200 UNV		pCi/L		
Heptachlor	RI/FS	121045	479544.93	1346398.61	4 U		ug/kg	0	0.5
Heptachlor	Unknown	009147	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Heptachlor epoxide	RI/FS	121045	479544.93	1346398.61	4 U		ug/kg	0	0.5
Heptachlor epoxide	Unknown	009147	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Hexachlorobenzene	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Hexachlorobenzene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Hexachlorobenzene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Hexachlorobutadiene	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Hexachlorobutadiene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5
Hexachlorobutadiene	Unknown	009147	479636.3832	1346433.968	480 U		ug/kg	0	0.5
Hexachlorocyclopentadiene	RI/FS	121045	479544.93	1346398.61	390 U		ug/kg	0	0.5
Hexachlorocyclopentadiene	RI/FS	118794	479636.3832	1346433.968	400 U		ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Hexachlorocyclopentadiene	Unknown	009147	479636.3832	1346433.968	480	UJ	ug/kg	0	0.5
Hexachloroethane	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
Hexachloroethane	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
Hexachloroethane	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
Indeno(1,2,3-cd)pyrene	RI/FS	121045	479544.93	1346398.61	40	J	ug/kg	0	0.5
Indeno(1,2,3-cd)pyrene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
Indeno(1,2,3-cd)pyrene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
Iron	RI/FS	118794	479636.3832	1346433.968	6220	-	mg/kg	0	0.5
Iron	Unknown	009147	479636.3832	1346433.968	8175.48	NV	mg/kg	0	0.5
Iron	Unknown	009147	479636.3832	1346433.968	8830	-	mg/kg	0	0.5
Iron	RI/FS	121045	479544.93	1346398.61	14100	-	mg/kg	0	0.5
Isophorone	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
Isophorone	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
Isophorone	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
Lead	RI/FS	118794	479636.3832	1346433.968	6.8	-	mg/kg	0	0.5
Lead	Unknown	009147	479636.3832	1346433.968	12.6857	NV	mg/kg	0	0.5
Magnesium	RI/FS	121045	479544.93	1346398.61	15300	-	mg/kg	0	0.5
Magnesium	Unknown	009147	479636.3832	1346433.968	18300	-	mg/kg	0	0.5
Magnesium	Unknown	009147	479636.3832	1346433.968	18648.7	NV	mg/kg	0	0.5
Magnesium	RI/FS	118794	479636.3832	1346433.968	29300	-	mg/kg	0	0.5
Manganese	Unknown	009147	479636.3832	1346433.968	415	-	mg/kg	0	0.5
Manganese	Unknown	009147	479636.3832	1346433.968	532.984	NV	mg/kg	0	0.5
Manganese	RI/FS	118794	479636.3832	1346433.968	546	J	mg/kg	0	0.5
Manganese	RI/FS	121045	479544.93	1346398.61	637	-	mg/kg	0	0.5
Mercury	RI/FS	118794	479636.3832	1346433.968	0.06	U	mg/kg	0	0.5
Mercury	RI/FS	121045	479544.93	1346398.61	0.06	UJ	mg/kg	0	0.5
Mercury	Unknown	009147	479636.3832	1346433.968	0.1	U	mg/kg	0	0.5
Mercury	Unknown	009147	479636.3832	1346433.968	0.8177	NV	mg/kg	0	0.5
Methoxychlor	RI/FS	121045	479544.93	1346398.61	40	U	ug/kg	0	0.5
Methoxychlor	Unknown	009147	479636.3832	1346433.968	120	U	ug/kg	0	0.5
Methylene chloride	RI/FS	121045	479544.93	1346398.61	12	U	ug/kg	0	0.5
Methylene chloride	RI/FS	118794	479636.3832	1346433.968	12	U	ug/kg	0	0.5
Methylene chloride	Unknown	009147	479636.3832	1346433.968	13	U	ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Molybdenum	RI/FS	121045	479544.93	1346398.61	4	U	mg/kg	0	0.5
Molybdenum	RI/FS	118794	479636.3832	1346433.968	4.1	U	mg/kg	0	0.5
Molybdenum	Unknown	009147	479636.3832	1346433.968	5	U	mg/kg	0	0.5
Molybdenum	Unknown	009147	479636.3832	1346433.968	242.396	NV	mg/kg	0	0.5
Naphthalene	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
Naphthalene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
Naphthalene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
Nickel	RI/FS	118794	479636.3832	1346433.968	6.8	-	mg/kg	0	0.5
Nickel	RI/FS	121045	479544.93	1346398.61	12.5	-	mg/kg	0	0.5
Nickel	Unknown	009147	479636.3832	1346433.968	19.5	-	mg/kg	0	0.5
Nickel	Unknown	009147	479636.3832	1346433.968	138.754	NV	mg/kg	0	0.5
Nitrobenzene	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
Nitrobenzene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
Nitrobenzene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
N-Nitroso-di-n-propylamine	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
N-Nitroso-di-n-propylamine	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
N-Nitroso-di-n-propylamine	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
N-Nitrosodiphenylamine	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
N-Nitrosodiphenylamine	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
N-Nitrosodiphenylamine	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
o-Methylphenol	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
o-Methylphenol	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
o-Methylphenol	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
p-Chloroaniline	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5
p-Chloroaniline	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
p-Chloroaniline	Unknown	009147	479636.3832	1346433.968	480	UJ	ug/kg	0	0.5
Pentachlorophenol	RI/FS	121045	479544.93	1346398.61	980	U	ug/kg	0	0.5
Pentachlorophenol	RI/FS	118794	479636.3832	1346433.968	2000	U	ug/kg	0	0.5
Pentachlorophenol	Unknown	009147	479636.3832	1346433.968	2300	U	ug/kg	0	0.5
Phenanthrene	RI/FS	121045	479544.93	1346398.61	71	J	ug/kg	0	0.5
Phenanthrene	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
Phenanthrene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
Phenol	RI/FS	121045	479544.93	1346398.61	390	U	ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Phenol	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
Phenol	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
p-Methylphenol	RI/FS	121045	479544.93	1346398.61	390	UJ	ug/kg	0	0.5
p-Methylphenol	RI/FS	118794	479636.3832	1346433.968	400	U	ug/kg	0	0.5
p-Methylphenol	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
Potassium	RI/FS	118794	479636.3832	1346433.968	267	-	mg/kg	0	0.5
Potassium	Unknown	009147	479636.3832	1346433.968	655	-	mg/kg	0	0.5
Potassium	RI/FS	121045	479544.93	1346398.61	1000	-	mg/kg	0	0.5
Pyrene	RI/FS	118794	479636.3832	1346433.968	60	J	ug/kg	0	0.5
Pyrene	RI/FS	121045	479544.93	1346398.61	120	J	ug/kg	0	0.5
Pyrene	Unknown	009147	479636.3832	1346433.968	480	U	ug/kg	0	0.5
Radium-226	RI/FS	121050	479544.93	1346398.61	0.2	J	pCi/g	0	0.5
Radium-226	RI/FS	118795	479636.3832	1346433.968	0.3	J	pCi/g	0	0.5
Radium-226	Unknown	009102	479636.3832	1346433.968	0.8	J	pCi/g	0	0.5
Radium-226	RI/FS	118782	479636.3832	1346433.968	0.8	UJ	pCi/g	0	0.5
Radium-226	Unknown	009038	479636.3832	1346433.968	0.9	J	pCi/g	0	0.5
Radium-226	Unknown	009153	479636.3832	1346433.968	1	J	pCi/g	0	0.5
Radium-228	RI/FS	121050	479544.93	1346398.61	0.5	-	pCi/g	0	0.5
Radium-228	RI/FS	118795	479636.3832	1346433.968	0.5	-	pCi/g	0	0.5
Radium-228	Unknown	009038	479636.3832	1346433.968	0.5	UJ	pCi/g	0	0.5
Radium-228	Unknown	009102	479636.3832	1346433.968	0.5	UJ	pCi/g	0	0.5
Radium-228	Unknown	009153	479636.3832	1346433.968	0.5	UJ	pCi/g	0	0.5
Radium-228	RI/FS	118782	479636.3832	1346433.968	0.8	-	pCi/g	0	0.5
Selenium	Unknown	009147	479636.3832	1346433.968	0.5	UJ	mg/kg	0	0.5
Selenium	Unknown	009147	479636.3832	1346433.968	1.0973	NV	mg/kg	0	0.5
Silicon	RI/FS	121045	479544.93	1346398.61	500	J	mg/kg	0	0.5
Silicon	RI/FS	118794	479636.3832	1346433.968	570	J	mg/kg	0	0.5
Silver	Unknown	009147	479636.3832	1346433.968	0.1	U	mg/kg	0	0.5
Silver	RI/FS	121045	479544.93	1346398.61	0.47	-	mg/kg	0	0.5
Silver	Unknown	009147	479636.3832	1346433.968	3.9342	NV	mg/kg	0	0.5
Sodium	RI/FS	121045	479544.93	1346398.61	104	U	mg/kg	0	0.5
Sodium	RI/FS	118794	479636.3832	1346433.968	141	U	mg/kg	0	0.5
Sodium	Unknown	009147	479636.3832	1346433.968	179.459	NV	mg/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Sodium	Unknown	009147	479636.3832	1346433.968	180	J	mg/kg	0	0.5
Strontium-90	RI/FS	121050	479544.93	1346398.61	0	U	pCi/g	0	0.5
Styrene	Unknown	009147	479636.3832	1346433.968	7	U	ug/kg	0	0.5
Styrene	RI/FS	121045	479544.93	1346398.61	12	U	ug/kg	0	0.5
Styrene	RI/FS	118794	479636.3832	1346433.968	12	U	ug/kg	0	0.5
Technetium-99	RI/FS	121050	479544.93	1346398.61	0.2	UJ	pCi/g	0	0.5
Tetrachloroethene	Unknown	009147	479636.3832	1346433.968	7	U	ug/kg	0	0.5
Tetrachloroethene	RI/FS	121045	479544.93	1346398.61	12	U	ug/kg	0	0.5
Tetrachloroethene	RI/FS	118794	479636.3832	1346433.968	12	U	ug/kg	0	0.5
Thallium	RI/FS	121045	479544.93	1346398.61	0.24	U	mg/kg	0	0.5
Thallium	RI/FS	118794	479636.3832	1346433.968	0.24	UJ	mg/kg	0	0.5
Thallium	Unknown	009147	479636.3832	1346433.968	0.3	U	mg/kg	0	0.5
Thallium	Unknown	009147	479636.3832	1346433.968	11.6419	NV	mg/kg	0	0.5
Thorium, Total	RI/FS	118795	479636.3832	1346433.968	2.73608	NV	pCi/g	0	0.5
Thorium, Total	RI/FS	118782	479636.3832	1346433.968	4.56009	NV	pCi/g	0	0.5
Thorium-228	RI/FS	118782	479636.3832	1346433.968	0.4	J	pCi/g	0	0.5
Thorium-228	RI/FS	118795	479636.3832	1346433.968	0.4	J	pCi/g	0	0.5
Thorium-230	RI/FS	118795	479636.3832	1346433.968	0.6	J	pCi/g	0	0.5
Thorium-230	RI/FS	118782	479636.3832	1346433.968	0.9	J	pCi/g	0	0.5
Thorium-232	RI/FS	118795	479636.3832	1346433.968	0.3	J	pCi/g	0	0.5
Thorium-232	RI/FS	118782	479636.3832	1346433.968	0.5	J	pCi/g	0	0.5
Toluene	Unknown	009147	479636.3832	1346433.968	7	U	ug/kg	0	0.5
Toluene	RI/FS	121045	479544.93	1346398.61	12	U	ug/kg	0	0.5
Toluene	RI/FS	118794	479636.3832	1346433.968	12	U	ug/kg	0	0.5
Toxaphene	Unknown	009147	479636.3832	1346433.968	240	U	ug/kg	0	0.5
Toxaphene	RI/FS	121045	479544.93	1346398.61	400	U	ug/kg	0	0.5
trans-1,3-Dichloropropene	Unknown	009147	479636.3832	1346433.968	7	R	ug/kg	0	0.5
trans-1,3-Dichloropropene	Unknown	009147	479636.3832	1346433.968	7	U	ug/kg	0	0.5
trans-1,3-Dichloropropene	RI/FS	121045	479544.93	1346398.61	12	U	ug/kg	0	0.5
trans-1,3-Dichloropropene	RI/FS	118794	479636.3832	1346433.968	12	U	ug/kg	0	0.5
Trichloroethene	Unknown	009147	479636.3832	1346433.968	7	U	ug/kg	0	0.5
Trichloroethene	RI/FS	121045	479544.93	1346398.61	12	U	ug/kg	0	0.5
Trichloroethene	RI/FS	118794	479636.3832	1346433.968	12	U	ug/kg	0	0.5

**APPENDIX A-2**  
**HISTORICAL DATA FOR THE SOUTHERN OXBOW AREA**

Parameter	Sampling Program	Sample ID	Northing	Easting	Result	Qualifier	Units	Top Depth	Bottom Depth
Uranium, Total	Unknown	009153	479636.3832	1346433.968	1 J		mg/kg	0	0.5
Uranium, Total	RI/FS	118782	479636.3832	1346433.968	1.7 -		mg/kg	0	0.5
Uranium, Total	RI/FS	118795	479636.3832	1346433.968	2.1 -		mg/kg	0	0.5
Uranium, Total	RI/FS	121050	479544.93	1346398.61	2.3 -		mg/kg	0	0.5
Uranium, Total	Unknown	009038	479636.3832	1346433.968	3 J		mg/kg	0	0.5
Uranium, Total	Unknown	009102	479636.3832	1346433.968	4 J		mg/kg	0	0.5
Uranium, Total	RI/FS	118766	479636.3832	1346433.968	9.3 NV		ug/L		
Uranium, Total	RI/FS	118783	479636.3832	1346433.968	11.6 NV		mg/kg	0	0.5
Uranium, Total	RI/FS	118797	479636.3832	1346433.968	15.8 NV		mg/kg	0	0.5
Uranium-234	RI/FS	118782	479636.3832	1346433.968	0.2 J		pCi/g	0	0.5
Uranium-234	RI/FS	121050	479544.93	1346398.61	32.7 J		pCi/g	0	0.5
Uranium-235/236	RI/FS	118782	479636.3832	1346433.968	0.1 UJ		pCi/g	0	0.5
Uranium-235/236	RI/FS	121050	479544.93	1346398.61	1.3 J		pCi/g	0	0.5
Uranium-238	RI/FS	118782	479636.3832	1346433.968	0.3 J		pCi/g	0	0.5
Uranium-238	RI/FS	121050	479544.93	1346398.61	30.7 J		pCi/g	0	0.5
Vanadium	RI/FS	118794	479636.3832	1346433.968	10 -		mg/kg	0	0.5
Vanadium	Unknown	009147	479636.3832	1346433.968	14 -		mg/kg	0	0.5
Vanadium	RI/FS	121045	479544.93	1346398.61	16.4 -		mg/kg	0	0.5
Vanadium	Unknown	009147	479636.3832	1346433.968	136.889 NV		mg/kg	0	0.5
Vinyl Acetate	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Vinyl Acetate	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Vinyl Acetate	Unknown	009147	479636.3832	1346433.968	15 U		ug/kg	0	0.5
Vinyl chloride	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Vinyl chloride	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Vinyl chloride	Unknown	009147	479636.3832	1346433.968	15 U		ug/kg	0	0.5
Xylenes, Total	Unknown	009147	479636.3832	1346433.968	7 U		ug/kg	0	0.5
Xylenes, Total	RI/FS	121045	479544.93	1346398.61	12 U		ug/kg	0	0.5
Xylenes, Total	RI/FS	118794	479636.3832	1346433.968	12 U		ug/kg	0	0.5
Zinc	Unknown	009147	479636.3832	1346433.968	24.4 J		mg/kg	0	0.5
Zinc	RI/FS	118794	479636.3832	1346433.968	30.5 -		mg/kg	0	0.5
Zinc	RI/FS	121045	479544.93	1346398.61	44.6 U		mg/kg	0	0.5
Zinc	Unknown	009147	479636.3832	1346433.968	157.858 NV		mg/kg	0	0.5

## **APPENDIX B**

**DATA QUALITY OBJECTIVES SL-056, Rev. 0**

Control Number \_\_\_\_\_

**Fernald Environmental Management Project****Data Quality Objectives**

Title: Real Time Final Remediation Level (FRL)  
Monitoring

Number: SL-056

Revision: 0

Effective Date: 9/01/99

Contact Name: Joan White

Approval: J. E. Clus Date: 9/1/99

James Chambers  
DQO Coordinator

Approval: Joan White Date: 9/1/99

Joan White  
Real-Time Instrumentation Measurement  
Program Manager

Rev. #	0						
Effective Date:	9/01/99						

**Data Quality Objectives**  
**Real Time Final Remediation Level (FRL) Monitoring**

**1.0 Statement of Problem**

**Conceptual Model of the Site**

The general soil remediation process at the Fernald Environmental Management Project (FEMP) includes real-time *in-situ* gamma spectrometry (real-time) measurements and physical sampling during different phases of the remediation process. Initially, pre-design investigations define excavation boundaries. During excavation, real-time measurements and/or sampling for waste disposition issues occurs. After planned excavations are complete, real-time measurements and/or physical sampling precertification activities are carried out to verify that residual contamination is below final remediation levels (FRLs).

This DQO describes the real-time *in-situ* gamma spectrometry methods used for gamma resolvable Area Specific Contaminants of Concern (ASCOC) FRL monitoring to support remedial design and precertification. Any physical soil samples collected to support remedial design will be collected under a separate DQO. Real-time FRL measurements involve field surveys of the surface soil using mobile and stationary gamma-discernable real-time equipment. Real-time FRL measurements are collected within an area when above-FRL radiological contamination is anticipated to be minimal based on process knowledge or previous investigations.

FRL scanning activities must follow the guidelines established in the *Sitewide Excavation Plan (SEP)* and the most current version of the document *User Guidelines, Measurement Strategies, and Operational Factors for Deployment of In-Situ Gamma Spectrometry at the Fernald Site* (hereinafter referred to as the Real Time Users Manual). As discussed in these documents, FRL measurements are conducted in two separate activities:

- FRL Phase I includes a mobile sodium iodide (NaI) detector scan of as much of the area as accessible at a 31 cm detection height at 1 mile per hour. If parts of the area of interest are inaccessible to the mobile NaI detectors, then the stationary High Purity Germanium (HPGe) detector will be used to obtain measurements in those areas. Target parameters for FRL Phase I NaI measurements are gross gamma activity and 3-times the FRL (3x FRL) values of total uranium, radium-226 and/or thorium-232, as calculated by a moving two-point average of consecutive measurements, or as indicated by 2x FRL in single measurements using the HPGe detectors at a 1 meter detector height.
- FRL Phase II includes stationary HPGe "hot spot evaluation" measurements at Phase I locations where the two-point average of total uranium, radium-226 and/or thorium-232 has identified resolvable ASCOC concentrations

greater than 3-times the FRL (3x FRL) using the RMS systems, or where single HPGe measurement from Phase I are greater than 2x FRL. Target parameters for FRL Phase II are all gamma resolvable radiological ASCOCs.

#### Available Resources

Time: FRL investigation of remediation areas or phased areas must be accomplished by the field team of real-time instrumentation operators (and samplers if necessary), to provide required information in time to support the design effort.

Project Constraints: FEMP remediation activities are being performed in support of the Accelerated Remediation Plan, and soil remediation activities must be consistent with the SEP. FRL scanning, and if necessary, sampling and analytical testing, must be performed with existing manpower and instrumentation, considering instrument availability, to support the remediation and certification schedule. The results of FRL Phase I will determine Phase II HPGe measurement location and if necessary, will determine physical sample location. Design and execution of potential remediation is dependent on successful completion of this work.

Instrumentation: Real-time monitoring includes mobile sodium iodide (NaI) systems referred to as the Radiation Measurement Systems (RMS). In addition, stationary germanium detectors mounted on a tripod (the HPGe), are also used. These instruments can significantly accelerate the pace of necessary characterization by detecting soil contaminated with gamma resolvable radiological ASCOCs in a rapid and non-intrusive manner.

#### **2.0 Identify the Decision**

##### Decision

Delineate the horizontal extent of above-FRL (hot spot criteria) radiological contamination in the area soil. In addition, determine the need for Phase II real-time measurements to further assist in the above-FRL delineation.

#### **3.0 Identify Inputs That Affect the Decision**

##### Required Informational Input

Real-time FRL measurements will be used to estimate the surface soil contamination and the variation in surface soil contamination in areas scheduled for design, modeling, precertification, or certification activities. In addition, RTIMP data may be used to determine physical sampling collection location and/or a review of existing physical sample data, process knowledge, or visible observation.

Sources of Informational Input

FRL measurements for gamma discernible radiological COCs will involve measurements from mobile and stationary in-situ gamma spectrometry equipment. Physical samples may be collected to verify real-time measurements, or to investigate non-gamma resolvable ASCOCs.

Action Levels

FRLs established in the OU2 and OU5 Records of Decision are specific for radiological COC, and in some cases, vary between remediation areas. The FRLs were developed to account for health risks, cross media impact, background concentrations, and applicable or relevant and appropriate requirements (ARARs) and represent not-to-exceed contaminant-specific average soil concentrations. Real-time HPGe measurements may also be taken to support excavation to ALARA requirements. Physical samples may be used to verify HPGe readings and to precertify for non-gamma resolvable ASCOCs.

The 3x FRL concentrations/activities obtained through two-point averaging of mobile NaI measurements have been developed based on the ability of the instrumentation to resolve these levels. Refer to the Real-Time User's Manual for additional details.

Methods of Data Collection

FRL Phase I measurements will be utilized to obtain as close to complete coverage of the areas of concern. Hot spot confirmation and delineation measurements will be obtained during FRL Phase II by strategically placed stationary HPGe measurements. Analysis and data management for FRL Phase I data will be conducted at ASL A. FRL Phase II data may be conducted at either ASL A or ASL B, at the discretion of the Project. The decision to collect Phase II data at ASL A, or ASL B will depend on the Project's need for validated data. Only ASL B data is subject to validation, at project request. Real-time data collection for Phase II ASL A and ASL B measurements are identical. All measurements will be performed in compliance with operating procedures, the Real-Time User's Manual, the SEP, and the SCQ.

The FRL Phase I data will be utilized to establish general radiological concentration patterns and detect areas of elevated total gamma activity, as well as provide isotopic information for resolvable ASCOCs. The FRL Phase II HPGe gamma detectors will be used to confirm and delineate Phase I potential hot spot measurements, as needed. All real-time Phase I and Phase II measurements will be collected in accordance with the procedures identified in Section 7.0 of this DQO.

Surface physical samples may be collected to verify HPGe measurements for

non-gamma resolvable ASCOCs. If physical sampling is needed, it will be identified in PSPs. The data quality of these samples will be consistent with the latest sampling DQO.

#### 4.0 The Boundaries of the Situation

##### Spatial Boundaries

Domain of the Decision: Boundaries are limited to surface soils of areas planned for certification, and adjacent areas, as defined in the individual work plans.

Population of Soils: The soils affected are surface soils (to a nominal depth of 6 inches), which include recently excavated surfaces and undisturbed soils associated with excavation areas as designated in the individual work plans.

##### Temporal Boundaries

Time Constraints on Real-Time Measurements: The scheduling of FRL scanning is closely associated with the design process and excavation schedule. FRL real-time scanning must be conducted prior to design, excavation, if any, and before certification activities begin. The scanning data must be returned and processed into useable format in time for the information to be useful within the current remediation schedule.

Practical Considerations: In-situ gamma spectrometry measurements cannot be made during snow coverage or standing water conditions or during precipitation. Field analytical methods should also be limited to unsaturated soils. Most areas undergoing scanning are flat, open terrain, and are readily accessible to the equipment. Some areas may require preparation, such as cutting of grass or removal of undergrowth, fencing and other obstacles. In situ measurements will require coordination with appropriate maintenance personnel for site preparation. Physical and environmental parameters will be recorded and assessed during data collection. Refer to the Real-Time User's Manual for additional details.

#### 5.0 Develop a Logic Statement

##### Parameters of Interest

For FRL Phase I, parameters of interest are gross gamma activity and 3-times the FRL values of total uranium, radium-226 and thorium-232, as calculated by a moving two-point average of consecutive readings. For FRL Phase II, parameters of interest are all HPGe-discernable radiological ASCOCs.

##### FRL Target Levels

For FRL Phase I, target levels are the highest gross gamma activity readings, 3x FRL for total uranium, radium-226 and thorium-232, and WAC trigger levels for total uranium. For FRL Phase II, target levels are the FRLs of all gamma discernable radiological ASCOCs including the WAC trigger level for total uranium.

#### Decision Rules

Following FRL Phase I, any Phase I NaI scanned areas exhibiting patterns of high gross gamma activity will be measured with the HPGe. Also, any Phase I HPGe measurements greater than 3x FRL will be scanned with the HPGe for hot spot evaluation per section 3.3 of the Real-Time User's Manual.

Following FRL Phase II, if HPGe results indicate an area could fail FRLs, the soil may be evaluated further with additional HPGe measurements or physical samples, or undergo remedial excavations. If remedial excavations are performed, the excavated area will be measured with post-excavation HPGe measurements to ensure removal of the contamination. Once the remediation is complete, FRL attainment is confirmed by the HPGe.

#### **6.0 Establish Constraints on the Uncertainty of the Decision**

##### Range of Parameter Limits

The range of surface soil concentrations anticipated will be from background (natural concentrations) to greater than 3X FRL.

##### Types of Decision Errors and Consequences

Decision Error 1: This decision error occurs when the decision maker decides an area meets FRLs when the average soil concentration in an area is above the FRL, or the soil contains ASCOC concentrations above the hot spot criteria (3x FRL for hot spots  $\leq 10 \text{ m}^2$ , or 2x FRL for hot spots  $> 10 \text{ m}^2$ ). This decision error would lead to the area failing certification for average radiological COC concentrations above the FRL or for hot spot criteria. If an area fails certification sampling and analytical testing, remobilization and further excavation, precertification, and certification sampling would be necessary.

Decision Error 2: This decision error occurs when the decision maker decides that additional HPGe and/or physical samples are necessary based on FRL Phase II results; or the decision maker directs the excavation (or additional excavation) of soils, when they actually have average radiological COC concentrations below the FRLs and no ASCOC hot spots (3x FRL for hot spots  $\leq 10 \text{ m}^2$ , or 2x FRL for hot spots  $> 10 \text{ m}^2$ ). This would result in added sampling and analytical costs and/or added costs due to the excavation of clean soils and an increased volume in the OSDF. This is not as severe as Decision Error 1. The addition of clean soil to the

OSDF would result in further reduction, although minimally, to human health risk in the remediated areas.

#### True State of Nature for the Decision Errors

The true state of nature for Decision Error 1 is that the actual concentrations of radiological ASCOCs are greater than their FRLs and/or the hot spot criteria. The true state of nature for Decision Error 2 is that the true concentrations of COCs are below their FRLs and/or hot spot criteria. Decision Error 1 would be the more severe error.

#### **7.0 Optimize a Design for Obtaining Quality Data**

As discussed in Section 3.3.3 of the SEP, FRL scanning consists of two separate activities. Refer to Section 1.0 of this DQO for a general overview of FRL Phase I and FRL Phase II activities.

Real-time measurements are generated by two methods: 1) the mobile sodium iodide (NaI) detection systems which provide semi-quantitative radiological data, and 2) the stationary high purity germanium (HPGe) system that provides quantitative measurements of radiological COCs. If necessary, physical samples may also be collected for HPGe data verification, and to precertify for non-gamma resolvable ASCOCs.

Surface moisture readings are obtained in conjunction with Phase I and Phase II the NaI and HPGe system measurements using the Troxler nuclear moisture and density gauge or the Zeltex moisture meter. If conditions do not permit the use of the moisture meters, a soil moisture sample may be collected and submitted to the on-site laboratory for percent moisture analysis, or a default moisture value of 20% may be used. The soil moisture data will be used as is discussed in Sections 3.8, 4.11 and 5.2 of the Real-Time User's Manual. The gamma data will be corrected to a dry weight equivalent.

Background radon monitoring will also occur in conjunction with Phase I and Phase II NaI and HPGe system measurements, as specified in the PSP. Refer to the Section 5.3 of the Real-Time User's Manual for a discussion on radium-226 corrections.

#### Sodium Iodide (NaI) System

The mobile NaI detector systems are collectively called the Radiation Measurement Systems (RMS). They are used to achieve as close to complete coverage of the area as possible, taking into consideration the topographic and vegetative constraints which limit access. The NaI systems currently are used to obtain measurements over an area specified in a PSP to detect radiological total activity

patterns and elevated radiological activity. The NaI detector systems are used at a 31 cm detector height at 1 mph for a 4 second acquisition with a 0.4 meter overlap, and are consistent with the Real-time User's Manual. If the total uranium FRL is 20 ppm or lower, the NaI systems should not be used for FRL attainment, the HPGe system should be used.

The mobile NaI systems are electronically coupled with a global positioning system (GPS) rover and base unit to record each measurement location. Counting and positioning information is recorded continuously on a field personal computer (PC) and stored on disk or hard drive for future downloading on the site soil database and Graphical Information System (GIS) system, or transferred directly to the Local Area Network (LAN) by Ethernet.

Information from the NaI/GPS system is recorded on the PC and transferred to the Unix system through the local area network on a regular (at least daily) basis. The information is plotted on the FEMP GIS system, or in the field using Surfer software. With the output, patterns of elevated total activity, and locations of elevated concentrations can be identified.

Data reduction is an important aspect of NaI system data use. Individual total uranium, radium-226 and thorium-232 concentrations will undergo two-point averaging. The two-point averaged values will be mapped and evaluated with respect to 3x FRL.

NaI measurements may be used for design, excavation during remediation, and precertification decision making if the measurements clearly indicate below FRL criteria have been met. They may also be used to determine the location and number of FRL Phase II HPGe measurements, if required.

#### In-Situ HPGe Detectors

The HPGe detector is used during FRL Phase I or FRL Phase II, as follows:

- During FRL Phase I, the HPGe is used in areas where topographic or vegetative constraints prevent mobile NaI detector access or if the NaI systems are out of service. The HPGe is used in a 99.1% coverage grid over the accessible area. Detector height is 1 meter with a count time of 15 minutes.
- During FRL Phase II, the HPGe detector is used at strategic locations established thorough the FRL Phase I screening. These locations are where the highest readings of gross gamma activity were identified and/or where individual ASCOC concentrations were identified as hot spots. The HPGe is used to identify radiological COC levels, which in turn provide information concerning the ability to pass FRLs. The number of Phase II HPGe

measurements to delineate the hot spot boundary varies based on the size of extent of contamination. If the area potentially exceeding the 2x FRL or 3x FRL exhibits a visible contamination boundary, the Project may determine that Phase II measurements may not need to be collected.

Physical Soil Sampling

Physical samples may be collected and analyzed for target radiological COCs to verify the HPGe measurements and/or to precertify for non-gamma discernable ASCOCs. If physical samples are required, they will be collected in compliance with the applicable sampling DQO. Criteria for obtaining physical samples, such as sample density, will be specified in the PSP, if necessary. The minimum data quality acceptable for this purpose will be identified in the applicable sampling DQO. Field QC, ASL and Validation requirements will be consistent with the SCQ and SEP requirements.

**Data Quality Objectives**  
**Real Time FRL Measurements**

- 1A. Task/Description: FRL real-time measurements.  
1B. Project Phase: (Put an X in the appropriate selection.)

RI  FS  RD  RA  R,A  OTHER

- 1.C. DQO No.: SL-056, Rev. 0 DQO Reference No.: Current Sampling DQO
- 

2. Media Characterization: (Put an X in the appropriate selection.)

Air  Biological  Groundwater  Sediment  Soil

Waste  Wastewater  Surface water  Other (specify) \_\_\_\_\_

---

3. Data Use with Analytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization  
A  B  C  D  E

Risk Assessment  
A  B  C  D  E

Evaluation of Alternatives  
A  B  C  D  E

Engineering Design  
A  B  C  D  E

Monitoring during remediation activities  
A  B  C  D  E

Other: Precertification  
A  B  C  D  E

---

- 4.A. Drivers: Applicable or Relevant and Appropriate Requirements (ARARs), Operable Unit 5 Record of Decision (ROD), the Real-Time User's Manual, the Sitewide Excavation Plan and the Project-Specific Plan (PSP).

- 4.B. Objective: To determine if the area of interest is likely to pass FRLs for all HPGe discernable radiological COCs
- 

5. Site Information (Description): The OU2 and OU5 RODs have identified areas at the FEMP that require remediation activities. The RODs specify that the soils in these areas will be clean and demonstrated to be below the FRLs.

000086

- 6.A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1. pH	<input type="checkbox"/>	2. Uranium	<input checked="" type="checkbox"/> *	3. BTX	<input type="checkbox"/>
Temperature	<input type="checkbox"/>	Full Rad.	<input checked="" type="checkbox"/> *	TPH	<input type="checkbox"/>
Spec. Conductance	<input type="checkbox"/>	Metals	<input type="checkbox"/>	Oil/Grease	<input type="checkbox"/>
Dissolved Oxygen	<input type="checkbox"/>	Cyanide	<input type="checkbox"/>		
Technetium-99	<input type="checkbox"/>	Silica	<input type="checkbox"/>		
4. Cations	<input type="checkbox"/>	5. VOA	<input type="checkbox"/>	6. Other (specify)	
Anions	<input type="checkbox"/>	ABN	<input type="checkbox"/>	Percent Moisture	
TOC	<input type="checkbox"/>	Pesticides	<input type="checkbox"/>		
TCLP	<input type="checkbox"/>	PCB	<input type="checkbox"/>		
CEC	<input type="checkbox"/>				
COD	<input type="checkbox"/>				

\* If specified in the PSP for NaI and HPGe detectable rad's.

6.B. Equipment Selection and SCQ Reference:

Equipment Selection	Refer to SCQ Section
ASL A <u>Mobile NaI, HPGe and HPGe*</u>	SCQ Section: <u>Not Applicable</u>
ASL B <u>HPGe*</u>	SCQ Section: <u>App. G , Table 1</u>
ASL C _____	SCQ Section: _____
ASL D _____	SCQ Section: _____
ASL E _____	SCQ Section: _____

\* Choosing the ASL level for Phase II FRL HPGe measurements is at the discretion of the project considering the project need for validated data.

7.A. Sampling Methods: (Put an X in the appropriate selection.)

000087

Biased  Composite  Environmental  Grab  Grid

Intrusive  Non-Intrusive  Phased  Source

- 7.B. Sample Work Plan Reference: The DQO is being established prior to completion of the Project-Specific Plans.

Background samples: OU5 RI/FS

- 7.C. Sample Collection Reference:

-EQT-22, *Characterization of Gamma Sensitive Detectors*  
-EQT-23, *Operation of High Purity Germanium Detectors*  
-EQT-32, *Troxler 3440 Series Surface Moisture Gauge*  
-EQT-33, *Real Time Differential Global Positioning System*  
-EQT-39, *Zeltex Infrared Moisture Meter*  
-EQT-40, *Satloc Real-time Differential Global Positioning System*  
-EQT-41, *Radiation Measurement Systems*  
-ADM-16, *In-Situ Gamma Spectrometry Quality Control*  
-User Guidelines, Measurement Strategies, and Operational Factors for Deployment of In-Situ Gamma Spectrometry at the Fernald Site, 20701-RP-0006

- 
8. Quality Control Samples: (Place an "X" in the appropriate selection box.)

- 8.A. Field Quality Control Samples:

Trip Blanks	<input type="checkbox"/>	Container Blanks	<input type="checkbox"/>
Field Blanks	<input type="checkbox"/>	Duplicate Samples	<input checked="" type="checkbox"/> *
Equipment Rinsate Samples	<input type="checkbox"/>	Split Samples	<input type="checkbox"/>
Preservative Blanks	<input type="checkbox"/>	PE Samples	<input type="checkbox"/>

Other (specify) Radon Monitoring, moisture \*

\* If specified in the PSP.

- 8.B. Laboratory Quality Control Samples:

Method Blank	<input type="checkbox"/>	Matrix Duplicate/Replicate	<input type="checkbox"/>
Matrix Spike	<input type="checkbox"/>	Surrogate Spikes	<input type="checkbox"/>

Other (specify) \_\_\_\_\_

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

000088